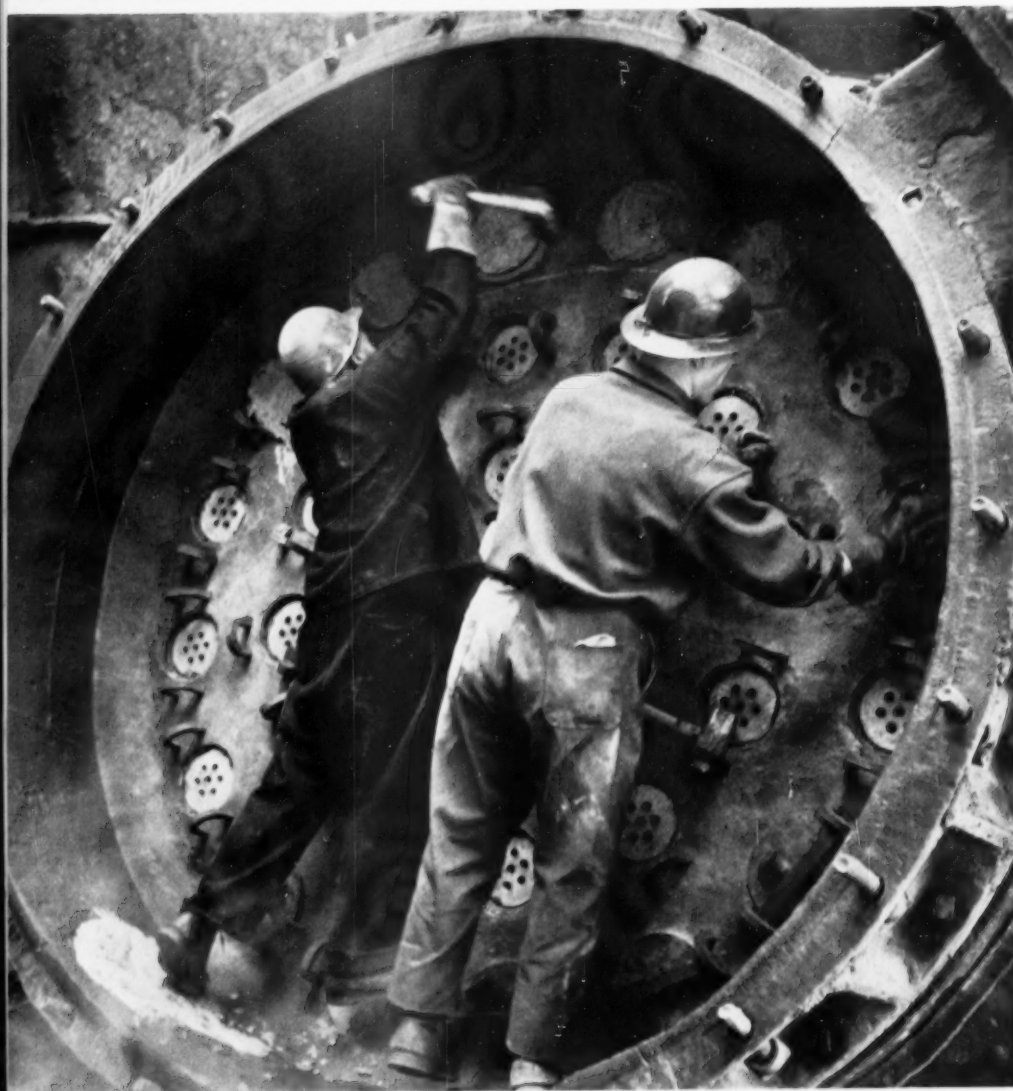


Compressed Air

OCTOBER 1956

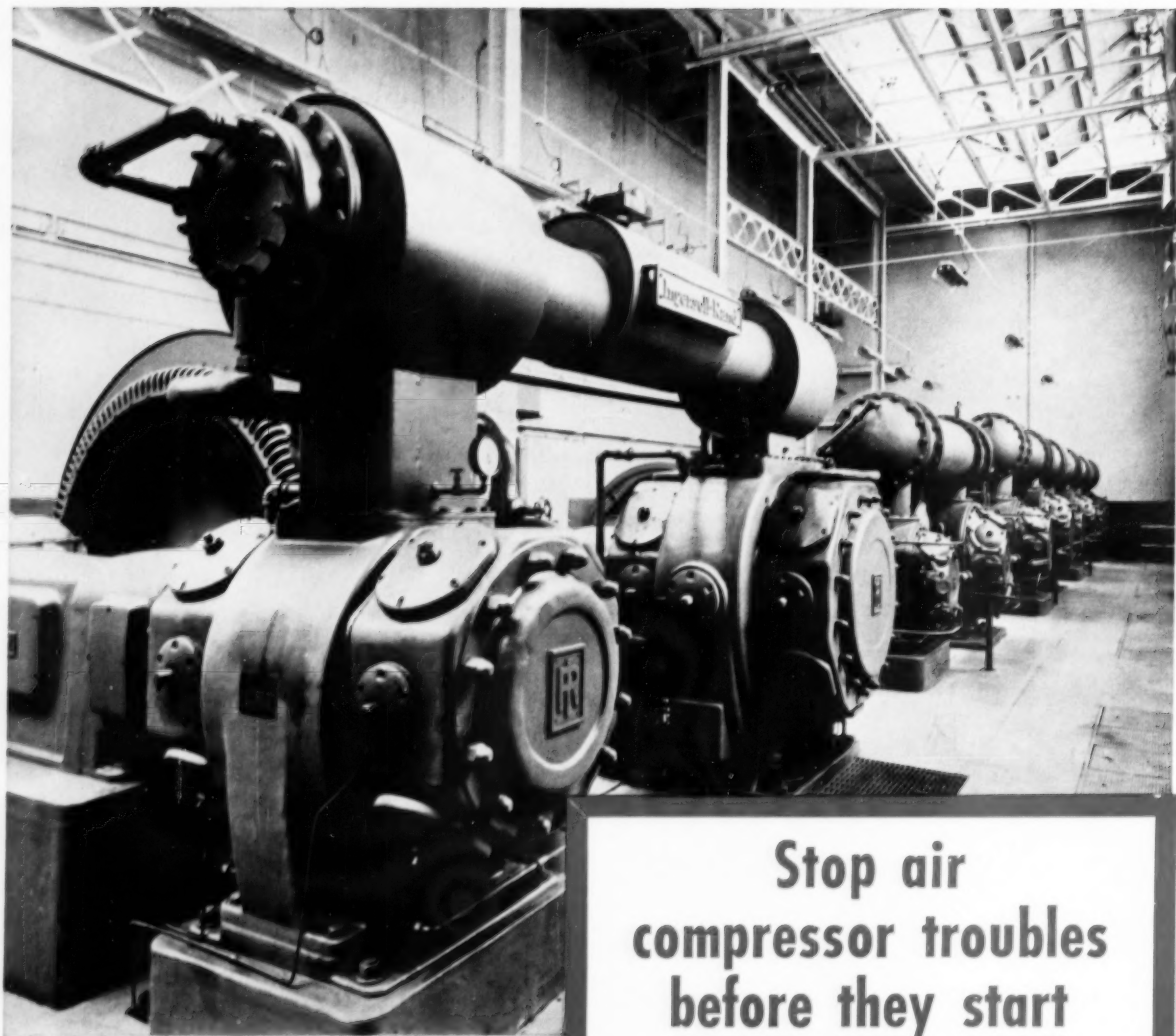
Magazine



**REPAIRING STEEL
MILL CONVERTER**
Workmen overhauling inlets
for air blast on bottom
of Bessemer vessel
(SEE INDEX PAGE)

VOLUME 61 • NUMBER 10

NEW YORK • LONDON



Stop air compressor troubles before they start

To assure top compressor efficiency—stop trouble before it starts—lubricate with the *right oil*, in the *right amount*, in the *right place*, at the *right time*.

Each of those "rights," of course, must be determined by the type and size of compressor and the operating conditions. And that's where a Texaco Lubrication Engineer can be of great help.

For the right oil, he will help you select the grade of *Texaco Regal Oil R&O* exactly suited to your compressor and its operating conditions, and will

guide you in its proper application. The compressor system will thus stay free from harmful deposits and rust. You will be assured dependable, trouble-free lubrication.

There is a complete line of *Texaco Regal Oils R&O* to meet the requirements of all compressors and operating conditions. Talk to a Texaco Lubrication Engineer today. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.



TEXACO Regal Oils R&O

FOR ALL AIR COMPRESSORS AND OPERATING CONDITIONS

KEEP IT CLEAN...

by Phil Traction



The uses for Dollinger Filters are truly "elephantine" . . . any liquid, gas, or air can be efficiently and economically handled by them.

Nearly all air-operated tools, instruments, controls, and industrial processes, must be protected from destructive dirt, dust, pipe scale, and condensates . . . and nothing does this job better than a Dollinger Pipe Line Filter.

Model CPH Pipe Line Filter, illustrated at the right, has the exclusive "double action principle." Air is first deflected to outer walls of Filter and forced downward at high speed. Water, oil, and heavier particles of rust, etc.

Model CPH
Pipe Line Filter

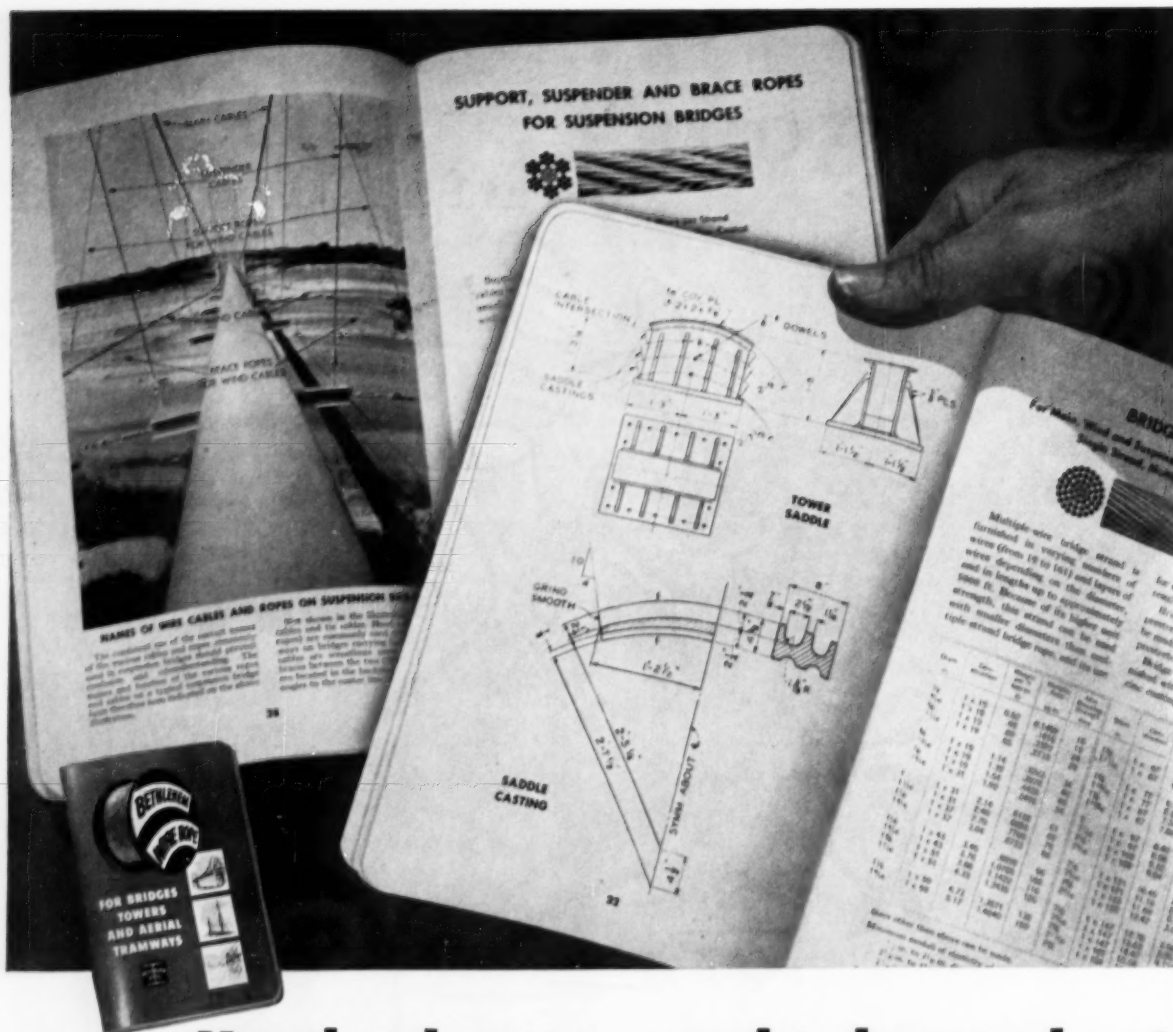


are thus deposited in base. Mechanically cleaned air then rises to pass through filtering medium which removes lighter air-borne particles. This "double action" design eliminates need for frequent cleaning.

Why not talk over your filtration problems with a Dollinger engineer . . . or write for bulletin 200 which gives engineering data on pipe line filters. Dollinger Corporation, 7 Centre Park, Rochester 3, N. Y.

DOLLINGER STAYNEW FILTERS

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS
ELECTROSTATIC FILTERS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS
VISCIOUS PANEL FILTERS • LOW PRESSURE FILTERS • HIGH PRESSURE FILTERS
AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS



Here's what you need to know about Cables for Bridges, Towers, Aerial Tramways

Bethlehem has just published a new and comprehensive handbook devoted to the uses of wire rope and strand in bridges, towers, aerial tramways, etc. This 160-page book is filled from cover to cover with practical information and interesting photographs. There are also drawings showing structural and anchorage details, and various types of sockets and clips. All in all, the book has more than 200 illustrations.

SEND FOR FREE COPY. A copy is yours for the asking. No charge, of course. Simply address your

Bethlehem makes bridge strand and bridge ropes in all the popular sizes. Moreover, our Williamsport plant has prestretching facilities for handling any length of strand or rope that can be manufactured and shipped.

request to Publications Dept., Bethlehem Steel Company, Bethlehem, Pa.

And when you have questions on cables and fittings, please feel free to consult personally with our engineers. These technicians are very close to the subject; they live with it and work with it every day. You'll find them friendly and cooperative, and always interested in helping you solve your problems.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

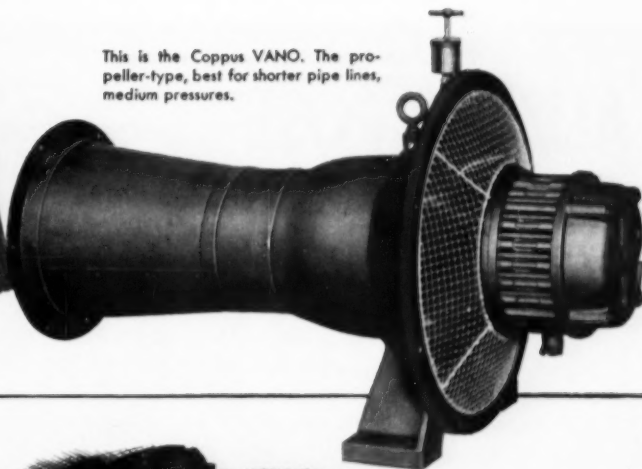
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

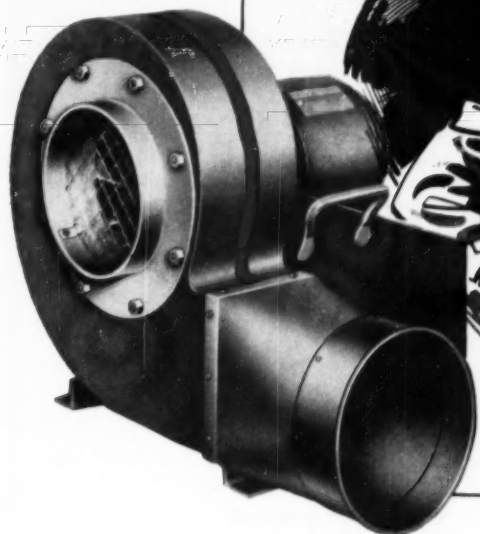


ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

This is the Coppus VANO. The propeller-type, best for shorter pipe lines, medium pressures.



This is the Coppus VENTAIR. A centrifugal blower, it is designed for long pipe lines, high pressures.



These are the cost-reducing Blowers that give up to 100% more air

Only Coppus makes both types — and both are made especially for *mine* ventilation. One or the other, operating under the conditions for which it is designed, delivers from 30% to 100% more air for a given power consumption than an ordinary all-purpose fan.

They can be used as blowers or exhausters and are driven either by compressed air or electric motor, with capacities up to 90,000 CFM. Like all Coppus products, these blowers wear the "Blue Ribbon" that stands for high achievement in engineering, workmanship and performance.

Representatives listed in *MINING CATALOGS*. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters

for special purposes. See also *THOMAS' REGISTER* . . .
Coppus Engineering Corp., Worcester 2, Mass.

COPPUS ENGINEERING CORPORATION

210 Park Avenue, Worcester 2, Mass.

Please send..... Bulletin 130

Name.....

Company.....

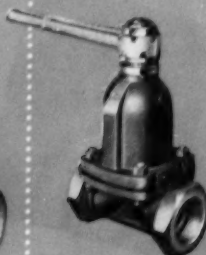
Address.....

ALL-PURPOSE VALVE

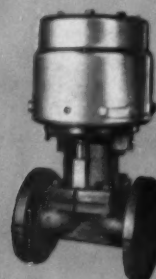
for handling materials as diversified as corrosive fluids, gases, beverages, viscous materials, foods, compressed air, solids in suspension.



Handwheel Operated



Lever Operated



Power Operated

Grinnell-Saunders Diaphragm Valve

Unsurpassed on lines where corrosion, abrasion, contamination, clogging, leakage and maintenance are costly factors.

In industries as varied as mining, food, textile, pulp and paper, beverage, water and sewage, chemicals . . . Grinnell-Saunders Diaphragm Valves continue to win enthusiastic acceptance. The unique design of the valve — with its flexible, long-wearing, tight-closing diaphragm — offers many unusual advantages.

If you have a valve problem, it will pay you to write Grinnell for further information.

GRINNELL

WHENEVER PIPING IS INVOLVED

Choice of Materials

Bodies — iron; cast steel; stainless steel; Durimet 20; Hastelloy A, B, C; bronze; Monel; aluminum; PVC (polyvinyl chloride); Saran

Body linings — hard rubber; soft rubber; neoprene; glass; lead; plastics; Heresite; Lithcote

Diaphragms — soft natural rubber; natural rubber; white synthetic rubber; neoprene; reinforced neoprene; butyl; Hycar; Teflon; Kel-F; PVC (polyvinyl chloride); polyethylene

Bonnets — iron; stainless steel; bronze; other materials on special order

Choice of Bodies

Conventional weir type

Straight bodies — screwed; flanged; socket weld; butt weld; socket (solder); sanitary threads; hose ends; Victaulic

Angle bodies — screwed; flanged; socket weld

Other types

A line of Straightway Valves (for straight-thru flow) and Full-Bore Valves (for ball brush cleaning) also are available

Choice of Bonnets

Handwheel (non-indicating stem, indicating stem); chain wheel; lever (for quick operation); sliding stem (for a wide selection of power operated topworks)

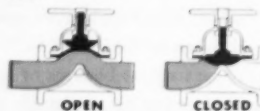
Operating Features

- diaphragm absolutely isolates bonnet mechanism from the fluid in the line

- diaphragm lifts high for streamline flow in either direction

- diaphragm presses tight for positive closure

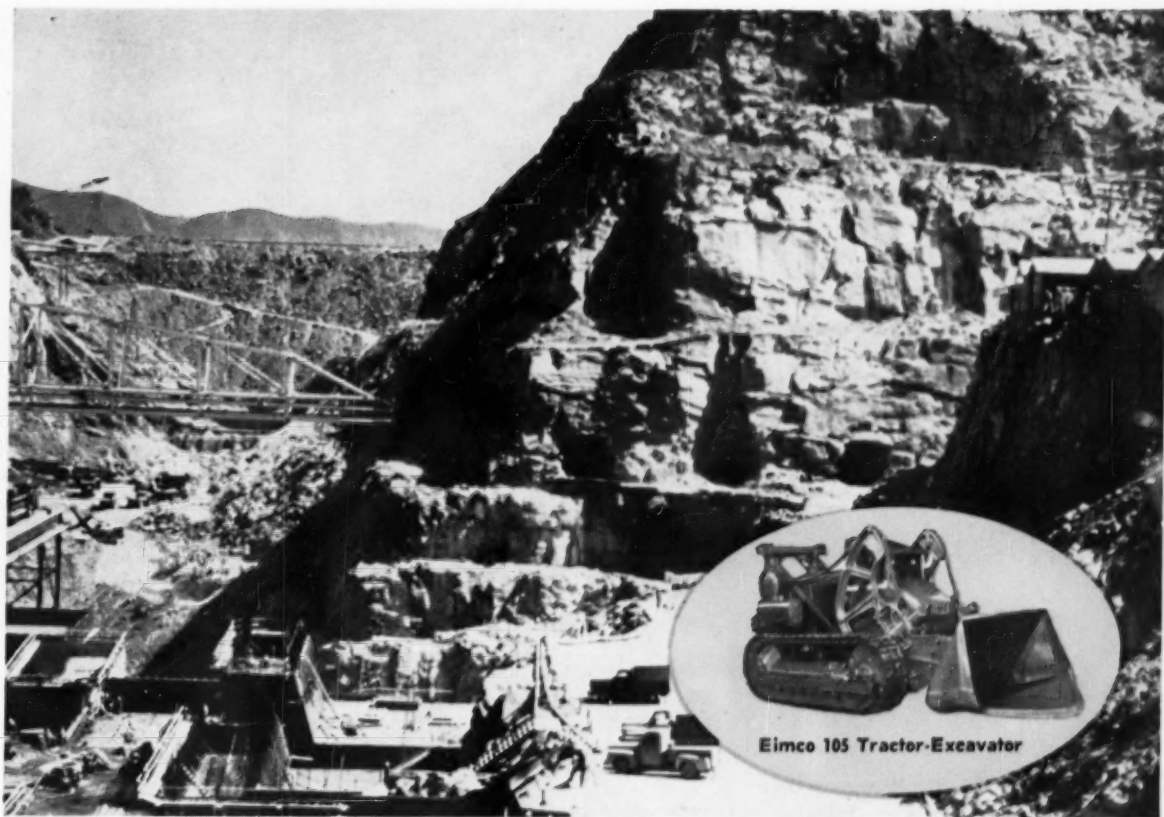
- simple maintenance — diaphragm easily replaced without removing valve body from line



Grinnell Company, Inc., Providence, Rhode Island

Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems



Eimco 105 Tractor-Excavator

INDIA - EIMCO 105's KEEP GRUELLING SCHEDULE

Two Eimco 105 Tractor-Excavators have each worked 8,000 hours in 12 months to keep progress on schedule at a huge dam project in India.

The machines have received intelligent maintenance and repairs have been small.

Eimco 105 Tractor-Dozer



At work on diversion, penstock and highway tunnels, trained Indian crews operating the 105's are doing an excellent job of tunnel driving. In some instances, advance for the size of tunnel being excavated may establish new world records.

"Eimco 105's are preferred equipment to use for tunnels of this type," says one official of a contracting firm. "The transmission, clutches and drive on both machines have not been touched in 8,000 hours of operation. They are in good condition and we expect them to last many more years."

Have you considered why the Eimco 105 is "preferred equipment" to contractors of huge dam, tunnel and road projects in the export market?

It's because their dependability is reflected through their engineered strength to stay on the job around the clock — day in and day out.

The Eimco 105's dependability eliminates the necessity of a sizeable parts depot. Eimco's are built to 100,000 hour standards for service in remote areas. Time saved by Eimco's working continuously with no down time for repairs is a big factor in selecting equipment.

Conditions being equal, Eimco 105's will produce more at less cost and in less time than comparative equipment. Let Eimco show you how this versatile unit can outperform and out-work heavier, more expensive units.

See the Eimco 105 before you buy any crawler tractor equipment.

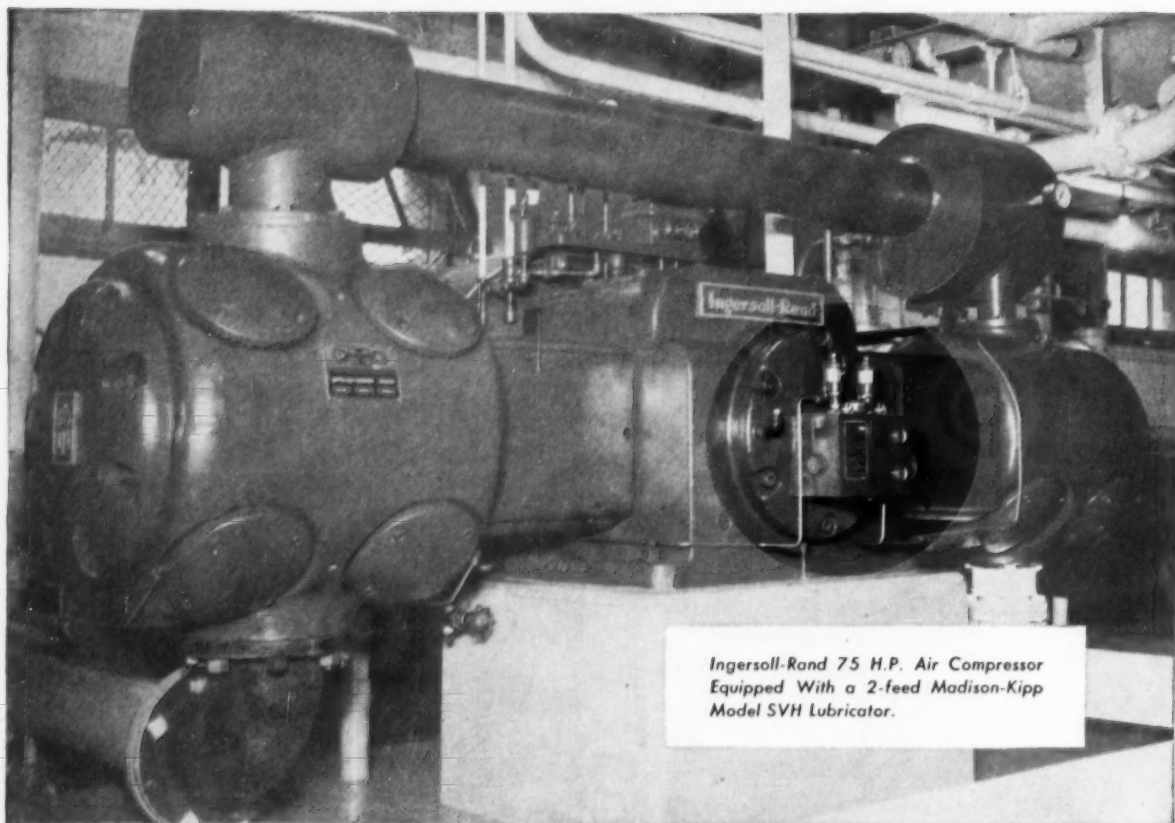
THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kelllogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Cleveland, Ohio Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa



B-214



Ingersoll-Rand 75 H.P. Air Compressor
Equipped With a 2-feed Madison-Kipp
Model SVH Lubricator.

**Machines of great performance use the most
dependable oiling system ever developed**

MADISON-KIPP

Fresh Oil

... by the measured drop,
from a Madison-Kipp Lubricator is the most dependable method of
lubrication ever developed. It is applied as original
equipment on America's finest machine tools, work engines
and compressors. You will definitely increase your
production potential for years to come by specifying
Madison-Kipp on all new machines you buy, where oil under
pressure fed drop by drop can be installed. There are
6 models to meet almost every installation requirement.

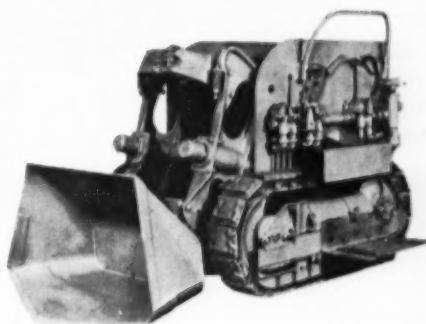
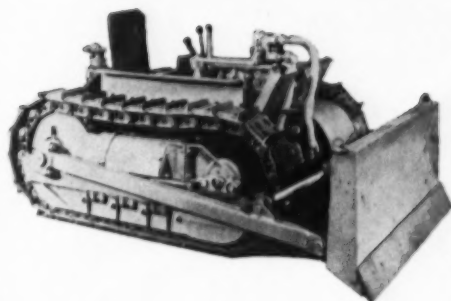


kipp

MADISON-KIPP CORPORATION
202 WAUBESA STREET • MADISON 10, WIS., U. S. A.

- Skilled in Die Casting Mechanics
- Experienced in Lubrication Engineering
- Originators of Really High Speed Air Tools

**NOW! IN CRAWLER TYPE MACHINES
FOR TRACKLESS WORK, THE SAME
HEAVY RUGGED CONSTRUCTION AND
DEPENDABILITY THAT THE INDUSTRY
HAS HAD IN EIMCO WHEEL TYPE
MACHINES.**



Fast, sharp maneuvers, regulated by fingertip control make the EIMCO 630 EXCAVATOR a production giant and an operator's delight.

With the power at his fingertips to move one track into forward motion while the other is in reverse motion, an operator can make the 630 veritably "walk" around a muck pile—working from any angle without backing to make a new approach.

Eimco 630 agility permits operators to quickly master movement of the machine to a point that lost motion is eliminated between excavating and discharge stages.

While the 630 is moving between points of excavation and dumping, the bucket progressively elevates in an arc. Through proper timing, arrival of the 630 and bucket discharge become simultaneous operations. And the large half-yard bucket provides greater tonnage at every discharge.

These three pluses—extra maneuverability, operational ease and larger bucket capacity added in terms of economic value to you mean **MORE TONNAGE IN LESS TIME.**



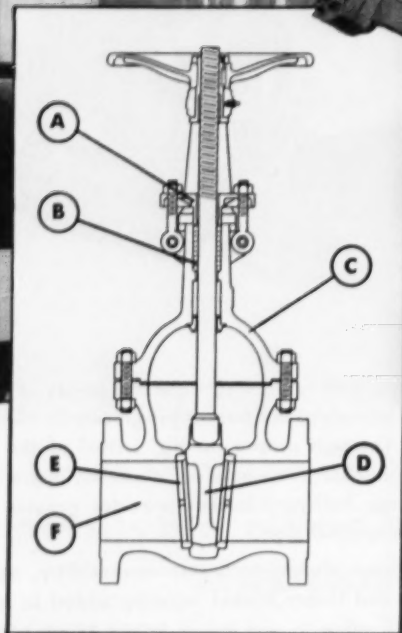
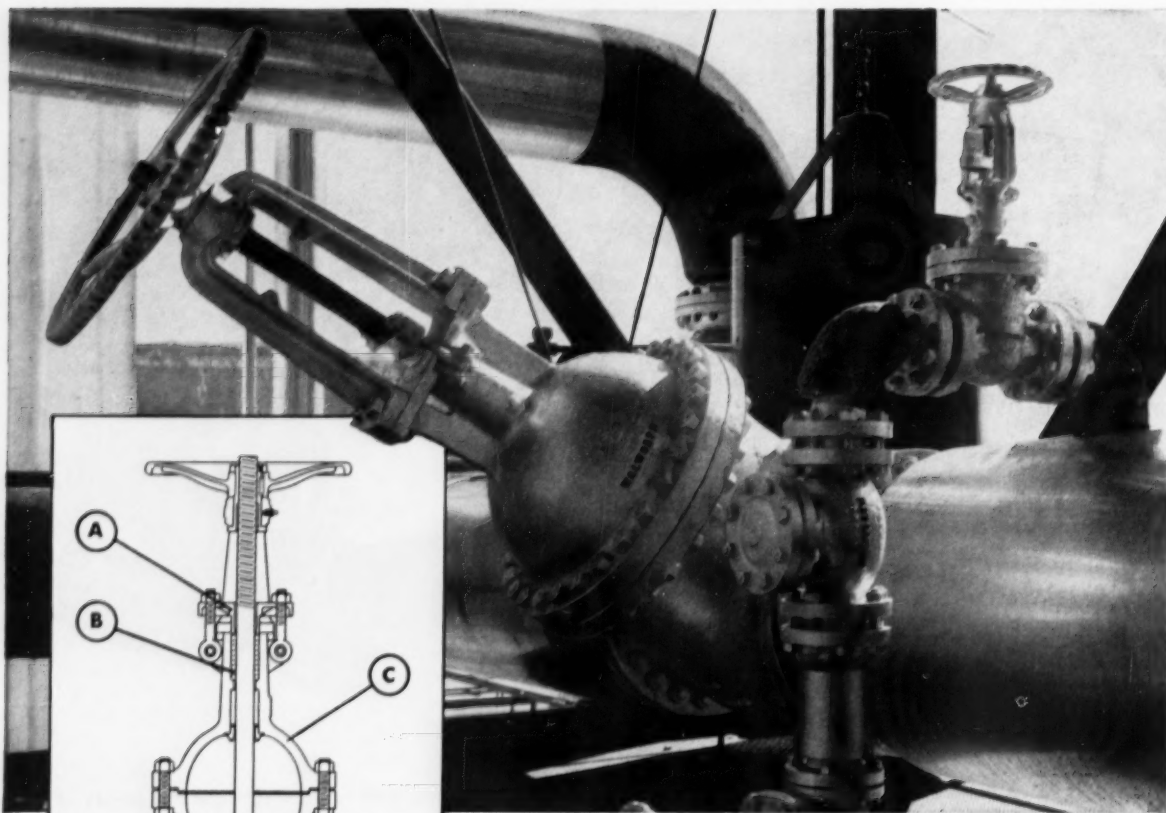
B-215

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A.

Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Pasadena, Calif. Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa



Walworth Series 150 and 300 CAST STEEL GATE VALVES OFFER YOU THESE FEATURES for 'round-the-plant service

(A) GLANDS: Clearances between the gland and stuffing box, and gland and stem, are such that the stem cannot be scored even if the gland is pulled down unevenly.

(B) DEEP STUFFING BOXES: More than adequate in all sizes (2" to 24") to assure tightness and maximum packing life.

(C) BONNETS AND BODIES: Engineered to exceed the requirements of all applicable codes and standards. They are tough, durable, dependable.

(D) INTEGRAL GUIDE RIB FACES IN BODY: Machined to insure accurate centering of the gate.

(E) STURDY SEAT RINGS: Bottom-seated so that no

recess exists at the back of the ring to cause turbulence, erosion and pressure drop.

(F) STREAMLINED PORTS: Permit unobstructed flow which results in minimum pressure drop and reduces the possibility of erosion.

Walworth Cast Steel Gate Valves can be furnished with either flanged ends or butt welding ends. Roller bearing yokes are available on the larger sizes. On valves 4 inches and larger, by-passes can be furnished. Walworth Cast Steel Gate, Globe and Check Valves from Series 150 to 2500, are available. For Series 600 and higher, we recommend Walworth Pressure Seal Cast Steel Valves. See your Walworth Distributor or write to Walworth for complete information.

WALWORTH

60 East 42nd Street, New York 17, New York

SUBSIDIARIES: **ALOYCO** ALLOY STEEL PRODUCTS CO.



CONOFLOW CORPORATION



M & H VALVE & FITTINGS CO.



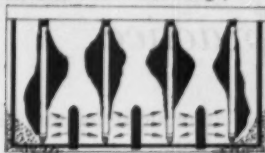
SOUTHWEST FABRICATING & WELDING CO., INC.



WALWORTH COMPANY OF CANADA, LTD.



Function of "impeller" design is agitation thru stirring. Results: Cake scour and uneven formation; vacuum loss at thin sections near the periphery of disc. (Other methods included pipes for air and steam bubbling.)



This "rake oscillating agitation" design (from drum filters) is equipped with upright pieces of various shapes to increase agitation. The result: Cake scour and uneven formations due to direction of thrust.



The Eimco Agidisc method now used provides agitation straight-up between the discs, giving the many advantages listed in text at right.

EIMCO AGIDISC FILTERS HAVE EXCLUSIVE ADVANTAGES

Eimco Hy-Flow Agidisc Filters give you these important advantages:

- 1) Even cake distribution without segregation.
- 2) Uniform thickness and dryness.
- 3) Higher tonnage capacity per square foot of filter area.
- 4) Drier cake.
- 5) Clean discharge.
- 6) Longer media life.
- 7) Lower maintenance costs.

After Eimco pioneered the agidisc filter, other manufacturers tried to match its performance by adding attachments to their existing filters.

Sketches at left readily show disadvantages of makeshift agitation.

The Eimco Agidisc is NOT a "patched up" version of other filter designs with doubtful operating merits. It is an integral unit. Scientific planning went into its distinctive design. Advantages were test-proven before it was marketed.

Confirmation that these filters are producing the advantages for which they were designed, is being received every day from Eimco Agidisc users.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

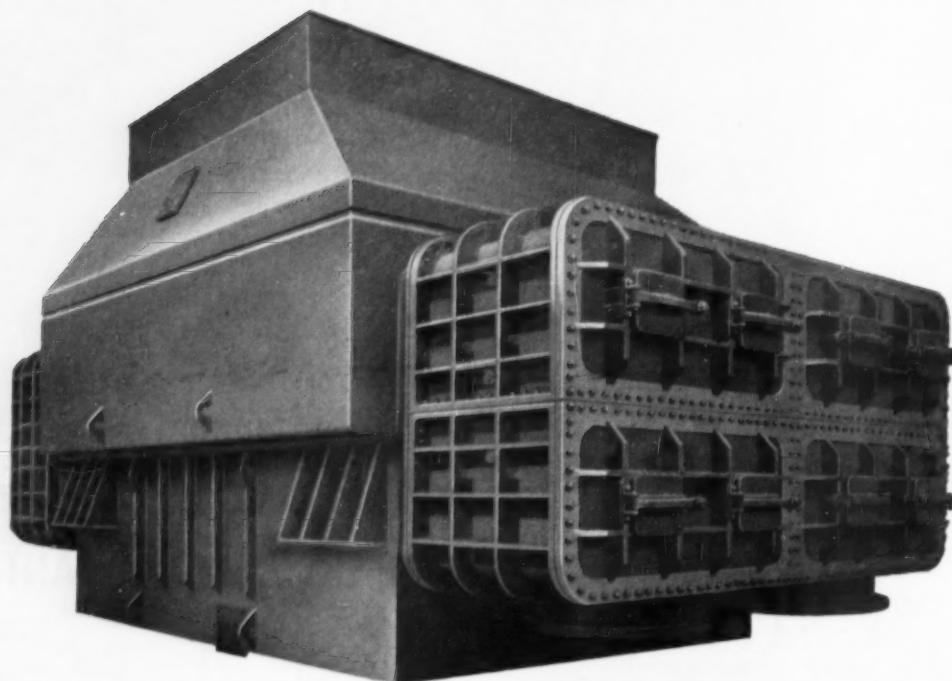
New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kalamazoo, Mich. Baltimore, Md. Pittsburgh, Pa. Seattle, Wash. Cleveland, Ohio Houston, Texas Vancouver, B. C. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa



B-217

SUPERIOR

of I-R condenser design



I-R space-saving surface condenser sets the pace in steam plant practice

FOR YEARS Ingersoll-Rand condensers have made possible a new concept of condenser design and efficiency. Incorporating controlled longitudinal steam distribution and graduated tube spacing, all I-R condensers feature an ultra-compact arrangement of internal elements in a rectangular shell. This permits maximum utilization of the condenser space available.

Continual refinements in design are contributing to ever smaller space requirements for a given condensing capacity. These developments conform with the modern trend to higher turbine efficiencies and more compact

turbine designs in reduced foundation areas for a given kw rating.

The I-R rectangular design permits varying the ratios of length, width and height without sacrificing condenser performance. Dimensional proportions can be changed over wide limits without departing from the basic standard arrangement of internal elements.

These advantages help make I-R condensers the most efficient available today — readily adaptable to all steam plant requirements. Your I-R engineer will be glad to give you further information.

4-445



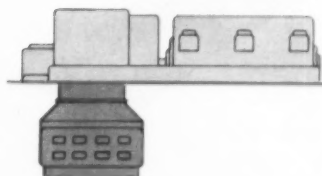
Ingersoll-Rand

11 Broadway, New York 4, N. Y.

COMPRESSORS • TURBO-BLOWERS • ROCK DRILLS • AIR TOOLS • CENTRIFUGAL PUMPS • CONDENSERS • GAS AND DIESEL ENGINES

ADAPTABILITY

**meets today's needs for all
turbine-condenser arrangements**



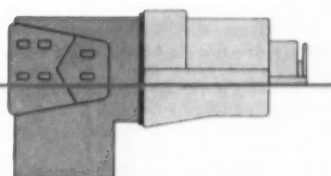
BOTTOM EXHAUST TURBINE

Regardless of headroom limitations, I-R surface condensers permit effective utilization of the space available. The sketch above represents a condenser of 65,000 sq ft, serving a 135,000 kw turbine. It requires a headroom of only 14 feet 8 inches. Maximum economy of installation, operation and maintenance is assured. The extreme versatility of the I-R condenser helps meet the widest range of modern steam plant requirements.



SIDE EXHAUST TURBINE

Mounted on the turbine floor, this Ingersoll-Rand condenser is integrated into the advanced design of a huge generating unit serving a large mid-western utility. The twin condenser shells are directly connected to the dual side exhausts of the cross-compound steam-turbine. In this way, the condenser can be selected for the most economical design proportions without regard to the usual limitations of headrooms and other space consideration. The entire condensing surface is above the operating floor.



AXIAL EXHAUST TURBINE

Another outstanding example of I-R adaptability is afforded by this condenser that connects directly to the exhaust of an axial flow exhaust turbine. The condenser unit is of the single-pass rectangular type, with divided water boxes. The result of close cooperation between I-R engineers and the turbine designers, it marks an important step forward in modern steam plant practice.

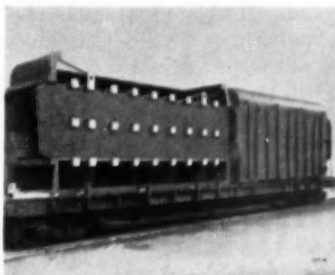
Another cost-saving feature of I-R condensers!

FACTORY ASSEMBLY AND FLANGED CONSTRUCTION

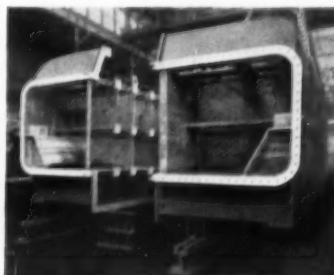
reduce field-fitting and erection welding

Every I-R condenser is assembled at the factory. Then it is disassembled and shipped in sections. Mating surfaces of the shell are machine-flanged, aligned and dowelled.

When the condenser arrives at the customer's plant, the shell sections are easily realigned and bolted together. This quality control feature is another reason why I-R condensers cost less to install.

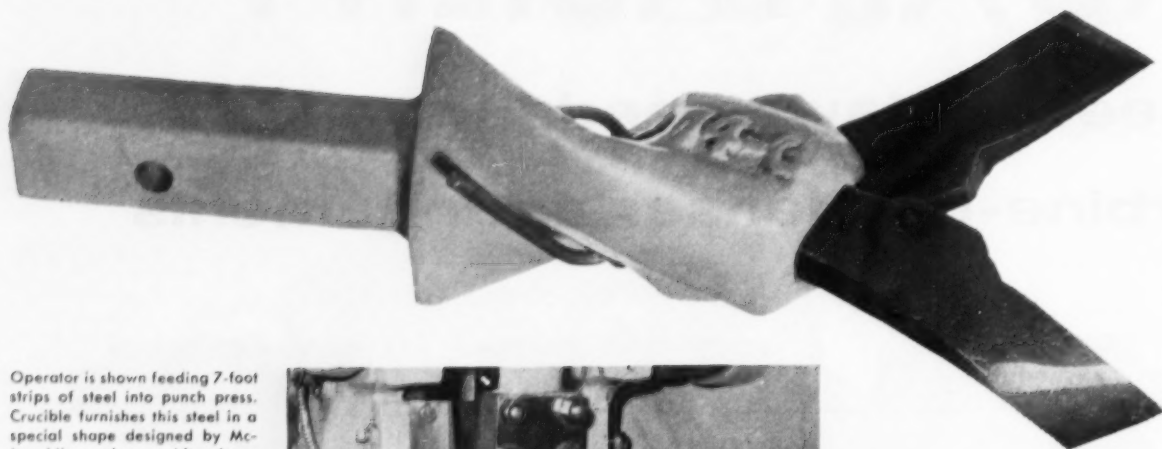


Mounted in sections on railway car, this condenser is going to customer's plant. When erected, all parts will line up perfectly

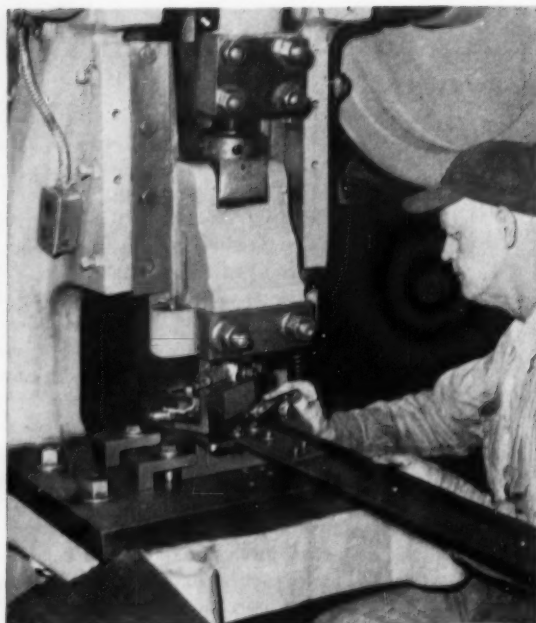


Full flanged joints and bolting pads of internal bracing on this condenser reduce field-fitting and welding

Bits of Crucible Silicon-Manganese alloy steel shown in holder. They are produced by McLaughlin Manufacturing Co., Inc., Joliet, Illinois.



Operator is shown feeding 7-foot strips of steel into punch press. Crucible furnishes this steel in a special shape designed by McLaughlin engineers. After forming to finished size, the bits are heat treated and the point and cutting edge are sharpened by hand.



special
CRUCIBLE
alloy
steel

gives bits maximum impact and abrasion resistance . . .

Cutting through abrasive materials like coal, soft limestone and shale demands a *special* steel. A steel that's hard without being brittle — that will take and *hold* a keen edge.

That's why Crucible produces a *special* Silicon-Manganese type alloy steel for the McLaughlin Manufacturing Co., Inc., manufacturers of these bits. It's a steel designed for optimum shock and abrasion resistance.

After McLaughlin tested Crucible's special alloy in the coal fields, their verdict was "This Silicon-Manganese steel is the finest alloy steel available."

Crucible will be glad to produce a *special* steel to meet your particular needs, too. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE

first name in special purpose steels

Crucible Steel Company of America

DISTRICT OFFICES

BOSTON, MASS.
339 Auburn Street
(Auburndale 66, Mass.)
Phone Decatur 2-7050

CHICAGO 14, ILL.
2701 N. Paulina Street
Phone Eastgate 7-8450

CINCINNATI 12, OHIO
2089 Sherman Ave., Room 53
Phone Jefferson 1-2855

CLEVELAND 14, OHIO
NBC Bldg. 815 Superior Ave., N.E.
Phone Cherry 1-0862

DALLAS 2, TEXAS
Second Unit Santa Fe Bldg.
Room 519
Phone Adams 5-7691

DAVENPORT, IOWA
705 Union Arcade Bldg.
Phone 6-3133

DETROIT 35, MICHIGAN
18228 James Couzens Hwy.
Phone University 2-5917

ERIE, PENNSYLVANIA
12th & Cranberry Streets
Phone 2-6436

GRAND RAPIDS, MICH.
The Jay Company
3251 Lake Michigan Drive, N. W.
Phone Glendale 6-8391

HOUSTON 21, TEXAS
P. O. Box 14284
409 Bastrop St.
Phone Capital 8-7581

INDIANAPOLIS 18, IND.
1701 N. Sherman Drive
P. O. Box 7151
Phone Fleetwood 7-1127, 7-1128

KANSAS CITY, MISSOURI
1102 E. 47th Street
Phone Valentine 1-0100

LANCASTER, PA.
Clair M. Williamson Associates
20 Race Avenue
Phone 4-1546

LOS ANGELES 21, CALIF.
Westco Pump Sales Co.
2315 E. 8th Street
Phone Madison 2754

MILWAUKEE 17, WIS.
316 E. Silver Spring Drive
Phone Woodruff 2-1235, 4-3911

MINNEAPOLIS 4, MINN.
The Edey Company
1302 Fifth Ave., South
Phone Federal 3-2813

NEWARK 4, NEW JERSEY
1245 McCarter Highway
Phone Humboldt 2-9233-4

NEW ORLEANS 20, LA.
Roussel Pump & Electric Co.
P. O. Box 9067
Phone Canal 0702

PHILADELPHIA 40, PA.
124 S. Easton Rd., Glenside, Pa.
Phone Turner 4-4668

PITTSBURGH 12, PA.
516 Federal St.
North Side Deposit Bank Bldg.
Phone Fairfax 1-4456

SAN FRANCISCO 24, CALIF.
Westco Pump Sales Co.
85 Industrial Street
Phone Valencia 6-5104-7

SEATTLE 16, WASH.
H. S. Emanuels
4015 Prince Street
Phone West 8700

SKANEATELES, N. Y.
P. O. Box 216
Phone 1093

TULSA 3, OKLA.
Bekin Bldg., 20 E. Archer St.
Phone Gibson 7-0520

WAUSAU, WISCONSIN
(Home Office)
Randolph & Cherry Streets
P. O. Box 630
Phone 2-2011 thru 2-2015
EXPORT DEPARTMENT
Marathon Electric Mfg. Corp.
431 Fifth Ave.
New York 16, New York
Phone Murray Hill 5-3322

Call Any Of The
Above Offices For
Complete Information

Why You Should Specify...



MOTORS & GENERATORS



Dependability

accepted by Leading National Manufacturers



Wide Range of Sizes

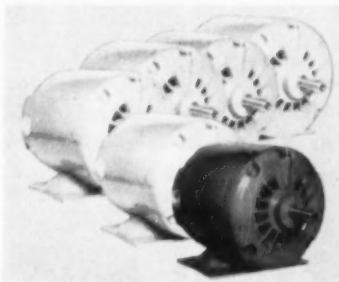
motors 1/20 H.P. to 2500 H.P. Generators 1/2 K.W. to 2000 K.W.

Built to Your Specifications



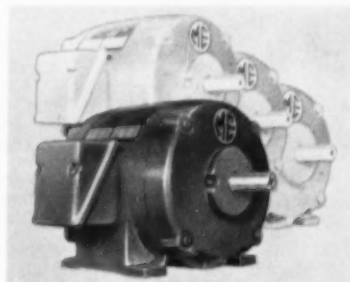
Nationwide Service

A Service Station and District Office is near you



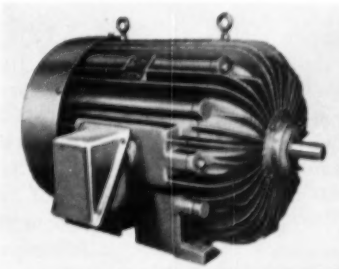
FRACTIONAL H.P. MOTORS

General Purpose:
1/20 HP-up From Stock
Special Purpose:
Built to YOUR Specifications



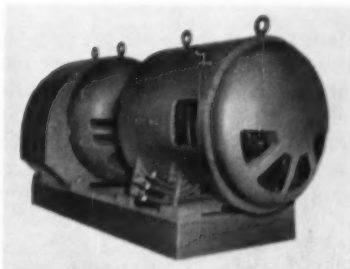
NEW NEMA INTEGRAL HP MOTORS

Provide 4 in 1 Protection:
Drip-proof . . . Splash-proof
Weather Protected . . . Guarded.
All at Open Motor Prices



TOTALLY ENCLOSED FAN-COOLED MOTORS

Ribbed Frame Construction:
Cool, Clean, Efficient
Explosion Proof Ratings to 250 HP
Carry This Label



LARGE APPARATUS

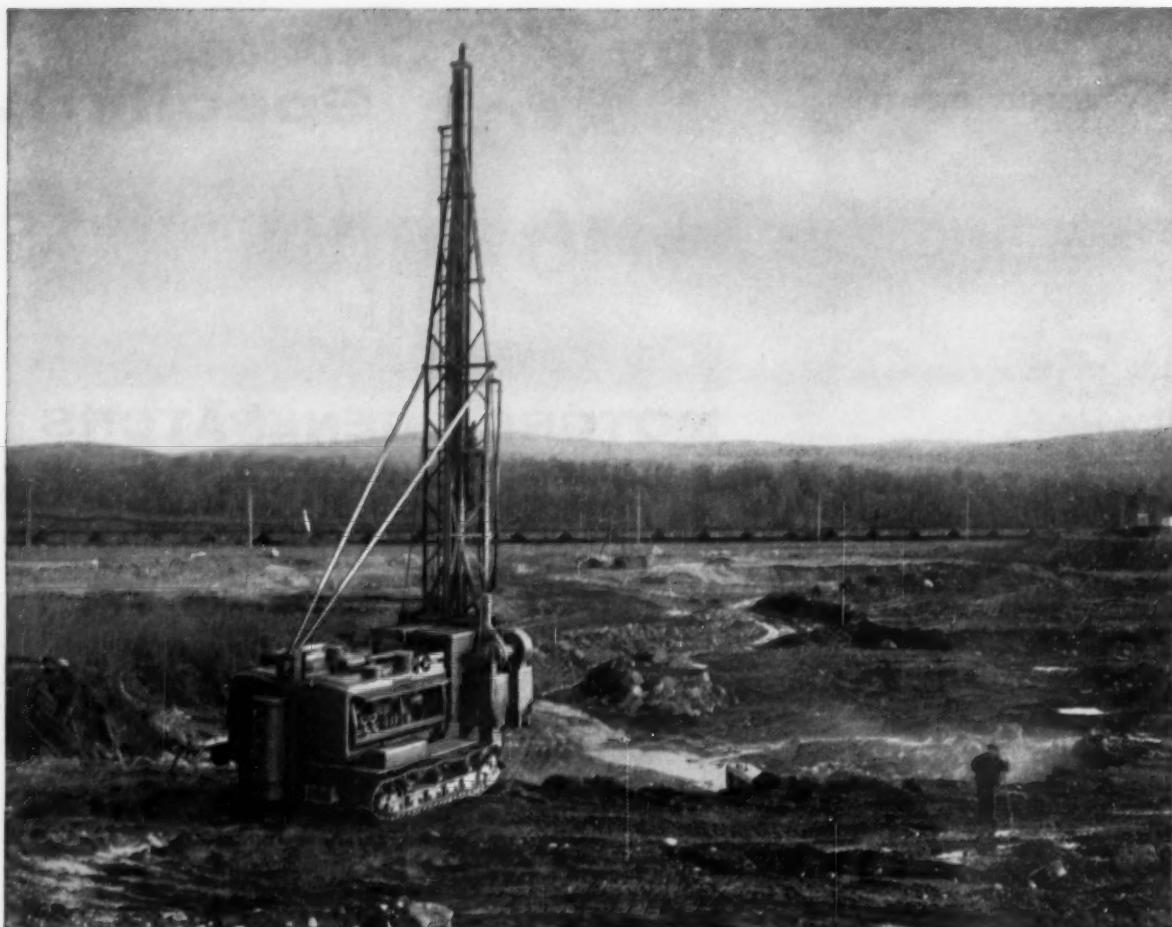
Synchronous & Wound Rotor Motors
Generators AC, DC, Hi-Frequency
Motor-Generator Sets
Automator-Adjustable Speed Drives

SINCE 1913

MARATHON ELECTRIC

HOME OFFICE AND FACTORY, WAUSAU, WIS.

SALES OFFICES IN PRINCIPAL CITIES



Highly maneuverable, the self-propelled Ingersoll-Rand Quarrymaster is powered by two 415 cfm

heavy-duty air compressors. In only minutes it moves from one hole to the next on air-operated tracks.

Nickel alloy steels help Quarrymaster drill blast holes that speed-up output

Operators of this open pit mine in upper New York State save time, sink fewer blast holes, and yet substantially step-up ore output of the property.

The Quarrymaster puts down large diameter holes thus making it possible to drill them much farther apart, center-to-center, and still secure equal or better fragmentation than conventional drills which put down a closer pattern of smaller holes.

Heat-treated nickel alloy steels help the Quarrymaster drill up to a 6" hole at a rate of 10 or more feet per hour in the hardest rock . . .

And in relatively soft rock it sinks holes at rates up to 80 feet per hour. The heart of this Quarrymaster is an air-operated piston drill, employing

hard, tough nickel alloy steels for vital parts.

Take its nickel alloy steel piston, for example. This part withstands continuous brutal battering by a tremendous load of more than 200 heavy blows per minute.

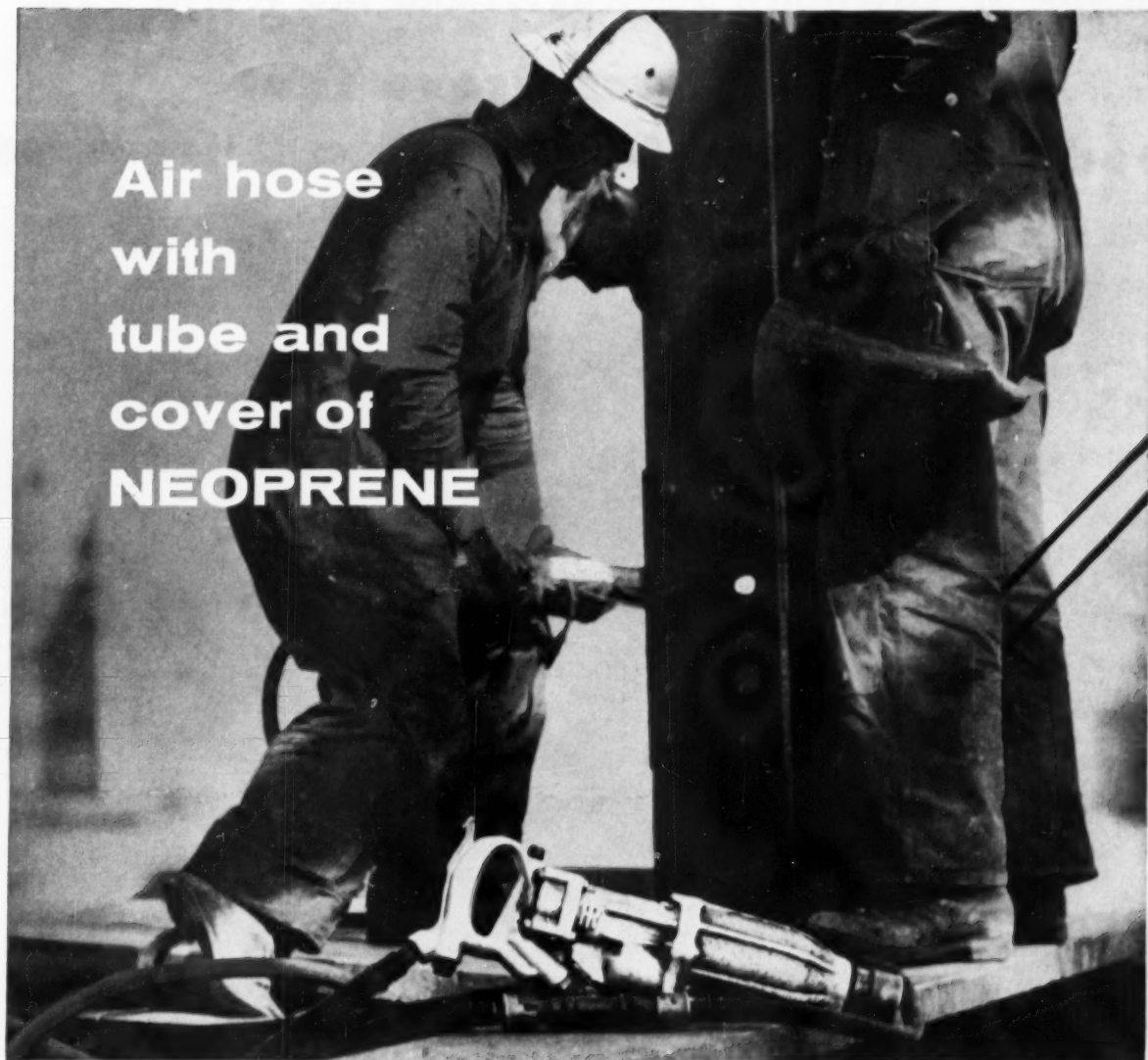
Rifle bar and other components, likewise are made of nickel steels to withstand correspondingly tough operating conditions.

Where use means abuse . . . as in the Quarrymaster . . . you can improve specific properties in many metals by alloying with nickel alone or in combination with other alloying elements. Send us details of your metal problems . . . we'll be glad to help you with suggestions for your specific applications.



THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street
New York 5, N. Y.

Air hose with tube and cover of NEOPRENE



Twisting, scuffing, oil and sun have little effect on this hose

Way up in dependability, way down in replacement costs—that's the story of hose made of Du Pont neoprene.

Neoprene tubes are flexible, resist the attack of oil in the line. As a result, they stay smooth, won't crumble and clog vital tool parts.

Covers of neoprene protect the fabric of the hose when it is dragged and twisted over sharp and abrasive objects. The neoprene covers give lasting protection because neoprene resists the deteriorating effects of oil and grease, sunlight and weather.

This double-duty protection, inside and out, is the reason why neoprene cover and tube are used as original equipment on most compressed air hose. The next time you order hose, be sure to specify Du Pont neoprene for extra-long service life.

FREE! The Neoprene Notebook

Each issue brings you new, unusual applications of neoprene . . . new products . . . interesting articles.



E. I. du Pont de Nemours & Co. (Inc.)
Elastomers Division, CA-10
Wilmington 98, Delaware

Please add my name to the mailing list of the NEOPRENE NOTEBOOK.

Name _____ Position _____
Firm _____
Address _____
City _____ State _____

NEOPRENE

The rubber made by Du Pont since 1932



BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

On the St. Lawrence Seaway...and the World Over

Bucyrus-Eries Prove that Good Equipment DOES Make a Difference



One of two Bucyrus-Erie 150-B 6-yd. shovels responsible for much of the 2.7 million cubic yards of excavation for the Iroquois control dam. This \$14-million structure will maintain the levels of Lake Ontario.

On the St. Lawrence Power and Seaway projects some extremely tough digging conditions have been encountered — glacial till with the density of concrete, sticky blue marine clay, and heavy boulders. In the thick of this rough going Bucyrus-Erie Ward Leonard electric shovels are handling big yardages, week after week, month after month — proving that good equipment *does* make a difference.

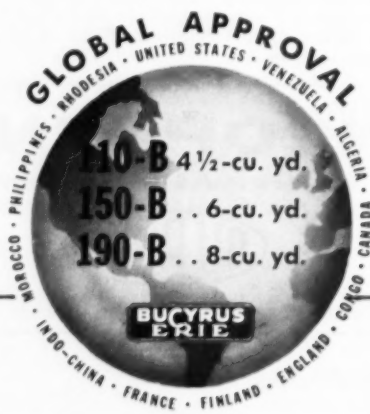
The extra margin of quality that makes these machines standouts on tough jobs gives you better performance in any digging. Their smooth-acting Ward Leonard electric control provides extra fast acceleration and deceleration to speed work cycles. Superior front-end design furnishes plenty of strength while reducing deadweight. And heavy-duty construction holds down maintenance costs as it lengthens machine life.

Bucyrus-Erie Ward Leonard electric shovels can make a difference on your jobs, too. We will be glad to provide complete information.

75L56C

BUCYRUS-ERIE COMPANY

SOUTH MILWAUKEE, WISCONSIN



ON THE COVER

IN OPERATION, a Bessemer converter is a spectacular pyrotechnical performer. Cooled off, it is a prosaic metal vessel that resembles a huge barrel with an open top. Our cover picture shows the bottom of one with the ends of its air inlets or tuyeres exposed. Through them is introduced the blast of thousands of cubic feet per minute of compressed air that oxidizes the impurities in the molten iron and converts it into steel by the shortest process known. The picture is published through the courtesy of Jones & Laughlin Steel Corporation and was taken at its Aliquippa Works, near Pittsburgh, Pa.

IN THIS ISSUE

UNTIL a few years ago all oxygen manufactured for industrial processes and hospitals was of high purity and rather expensive. The discovery of a way of making 95-percent pure oxygen at low cost has opened the way for its wholesale use in metallurgy. One of the biggest oxygen generating plants on this continent is supplying gas to a smelter in Canada. Page 292.

TO GET the illustrations for our article on an Alaskan chrome mine, Mrs. Nona H. Johnson, who lives at Seldovia, closest settlement to it, hitched a ride on a dump truck that was returning to the mine for another load of ore. Of this experience, she wrote: "My precious Speed Graphic bounced on my lap as we tore along the one-way trail that they so loosely term a road. As we jolted about in the cab, I began to think of the trip back down and didn't look forward to it in the least." However, on pages 296-99 we present evidence that she and her camera received safe transport to the lowlands.

AFTER a 20-month trip from New Jersey through the soft bed of the Hudson River, the shield of the Lincoln Tunnel Third Tube arrived at its New York target right on grade and only $\frac{3}{4}$ inch off line. This is pretty accurate "blind flying," as one observer remarked. Parts 2 and 3 of our account of the tunneling start on page 300.

THE differences between roadbuilding equipment used nearly half a century ago and today are strikingly portrayed on pages 307-309.

Compressed Air Magazine

COMPRESSED AIR MAGAZINE COMPANY 1936

VOLUME 61

October, 1956

NUMBER 10

G. W. MORRISON, *Publisher* C. H. VIVIAN, *Editor*
ANNA M. HOFFMANN, *Associate Editor* J. W. YOUNG, *Advertising Director*
R. J. NEMMERS, *Assistant Editor* FRANCIS HARTMAN, *Circulation Mgr.*
J. J. KATARBA, *Business Mgr.* R. W. SAPORA, *Foreign Circulation Mgr.*
D. Y. MARSHALL, *Europe*, 243 Upper Thames St., London, E. C. 4.
F. A. McLEAN, *Canada*, New Birks Building, Montreal, Quebec.

EDITORIAL CONTENTS

Oxygen by the Ton—C. H. Vivian	292
Chrome from Alaska—Allen S. Park	296
Lincoln Tunnel Third Tube, Parts 2 and 3—C. H. Vivian	300
Roadbuilding Equipment of Two Eras, 1909-1956	307
Drilling Starts on \$81 Million Power Project	310
Editorials—Manna for the Railroads—Beware of Blasting Caps—Feast or Famine	311
This and That	312
Breezy's Boner	313
Industrial Notes	314
Briefs	319
Books and Industrial Literature	321

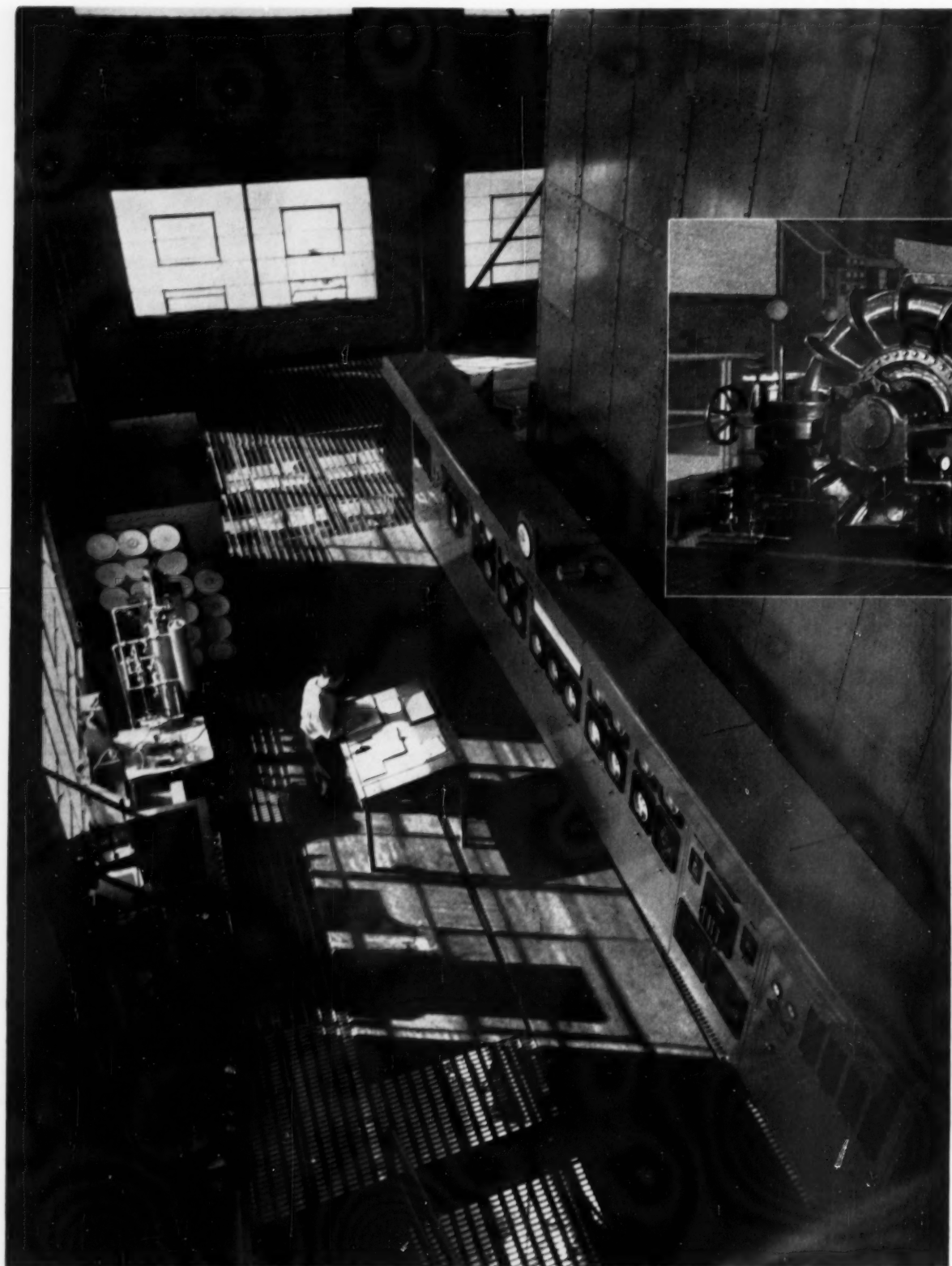
ADVERTISING CONTENTS

Adams Co., Inc. R.P.	23	Ingersoll-Rand Co.	12, 13, 25, 39
Allis Co., The Louis	32	International Nickel Co., The	16
American Air Filter Co., Inc.	37	Madison-Kipp Corporation	8
Anaconda Company, The	33	Marathon Electric	15
Armstrong Machine Works	27	Maxim Silencer Company, The	21
Bethlehem Steel Company	4, 31	M - B Products	30
Bucyrus-Erie Company	18	National Forge and Ordnance Co.	35
Celanese Corp. of America	38	Naylor Pipe Company	22
Compressed Air Magazine Co.	30	New Jersey Meter Company	20
Continental Motors Corporation	29	N.Y. & N.J. Lubricant Co.	19
Coppus Engineering Corp.	5	Niagara Blower Company	28
Crucible Steel Co. of America	14	Rockwell Manufacturing Co.	
Diehl Manufacturing Co.	36	Nordstrom Valve Division	26
Dollinger Corporation	3	Sarco Company, Inc.	27
du Pont de Nemours & Co., E.I.	17	Schraders' Son, A.	3rd Cover
Eimco Corporation, The	7, 9, 11	Texas Company, The	2nd Cover
Garlock Packing Company, The	24	Timken Roller Bearing Co.	
Goodall Rubber Company	27		Back Cover
Grinnell Company, Inc.	6	Walworth Company	10
Hercules Powder Company	34	Wood's Sons Co., T. B.	30

A monthly publication devoted to the many fields of endeavor in which compressed air serves useful purposes. Founded in 1896.

EPA Member Business Publications Audit of Circulation, Inc.

Published by Compressed Air Magazine Co., G. W. MORRISON, *President*
C. H. VIVIAN, *Vice-President* A. W. LOOMIS, *Vice-President*
J. W. YOUNG, *Secretary-Treasurer*
Editorial, advertising, and publication offices, Phillipsburg, N. J.
New York City Office, 11 Broadway, L. H. GEYER, *Representative*
Annual subscription: U.S., \$3.00, foreign, \$3.50. Single copies, 35 cents.
COMPRESSED AIR MAGAZINE is on file in many libraries and is indexed in Industrial Arts Index and in Engineering Index.



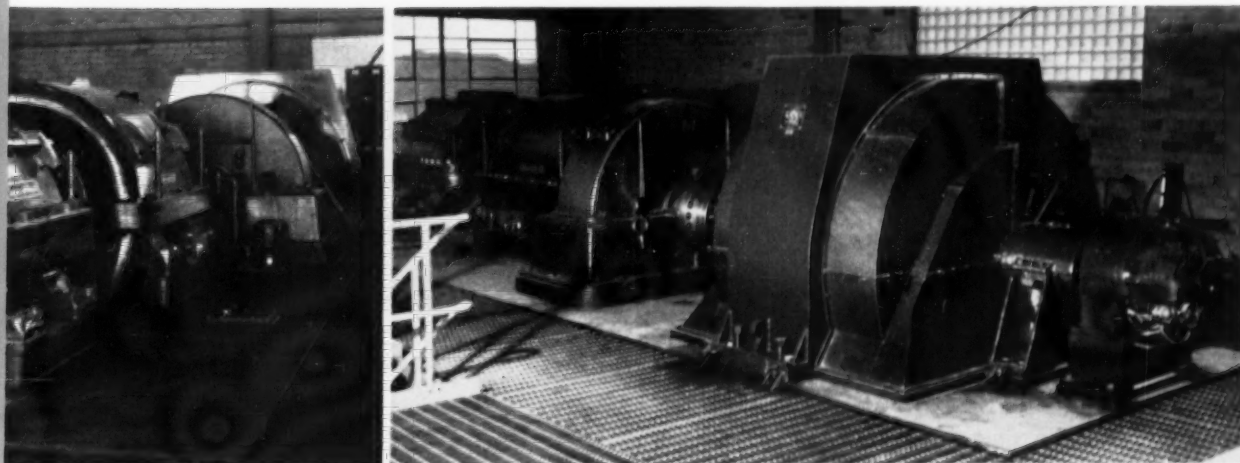
CONTROL PANEL VIEWED FROM ABOVE

Despite the size and intricacies of the Oxyton, its operation is essentially automatic once the air-liquefaction process has been started. Here, in the nerve center of the plant,

more than 40 control and metering instruments are mounted on the 35-foot-long board. Readings are being recorded by the operator at the small desk in front of it.

OXYGEN BY THE TON

C. H. VIVIAN



MAIN COMPRESSOR

SMELTING of copper-sulphide concentrate by a new process in which oxygen replaces heat from burning fuel is being carried on by The International Nickel Company of Canada, Limited, at Copper Cliff, Ont. The company produces about 250 million pounds of copper annually.

Called oxygen flash smelting, the process was originated by Inco technologists who began their investigations in 1945. They had the coöperation of Canadian Industries Limited and Canadian Liquid Air Company, Ltd., in developing it. Now entering its fifth year of full-scale use, it has reduced smelting costs and resulted in the production and recovery of a by-product furnace gas that is the source of liquid sulphur dioxide and sulphuric acid.

The low-cost oxygen that makes the process economically possible is obtained from a plant so large that it measures its output by the ton and is consequently called Oxyton. Built for Inco by Canadian Liquid Air Company, the unit turns out 325 tons of 95-percent-pure oxygen every 24 hours, corresponding to $2\frac{2}{3}$ billion cubic feet per year, or three times the output of all the cylinder oxygen plants in Canada. It is reported to be the third largest facility of its kind.

The conventional treatment of copper-sulphide concentrate, which is derived in this case from the flotation milling of chalcopyrite (copper-iron sulphide), involves smelting in reverberatory furnaces with pulverized coal or other fuel,

As the first step in the liquefaction process, incoming air is compressed to approximately 66 psi by two Ingersoll-Rand turbo-blowers arranged in tandem as a single unit with an inlet capacity of 31,100 cfm. They are driven through speed-increasing gears by a General Electric 6000-hp synchronous motor. These pictures show the machine from the high-pressure blower end, left, and from the motor end.

with or without prior roasting. The matte formed contains a large proportion of iron sulphide, which is subsequently removed by oxidation and slagging in Bessemer converters. The slag thus produced is returned to the reverberatory furnaces. The copper sulphide remaining is "blown" to blister copper, which is then refined for commercial use. At Inco, it was formerly the practice to charge wet copper concentrate with flux into the reverberatory furnaces and to smelt with pulverized coal.

In the flash-smelting process, finely divided concentrate and flux are dried and injected with oxygen into the preheated furnace. As the oxygen reacts with the mineral, iron and sulphur burn, creating heat. The ore smelts itself, eliminating the need of other fuel. Copper collects in the matte, iron and rock in the slag. The gases, which were previously wasted, contain about 75 percent of sulphur dioxide—up to 300 tons of it a day. An important feature of the system is a novel method of cleaning the copper-rich slag by flash smelting

pyrrhotite (iron sulphide) at the skimming end of the furnace. The slag is showered with iron-sulphide droplets which, in settling into the matte beneath, extract copper from the slag.

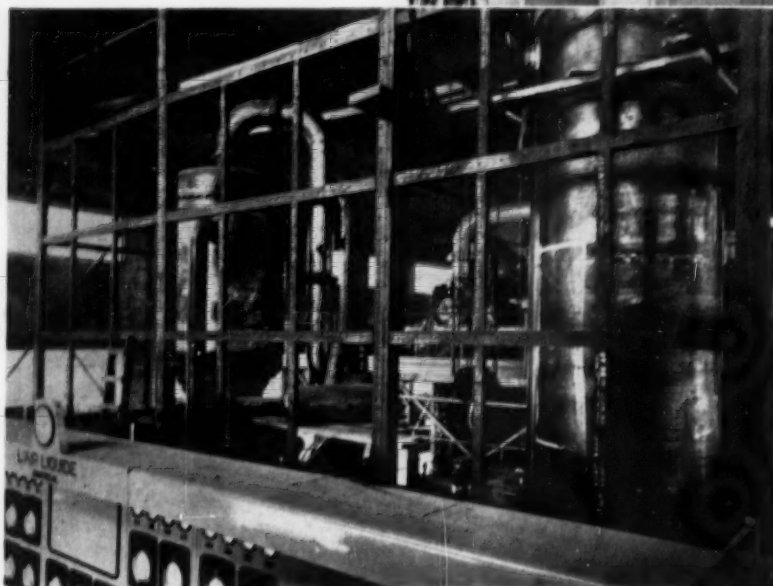
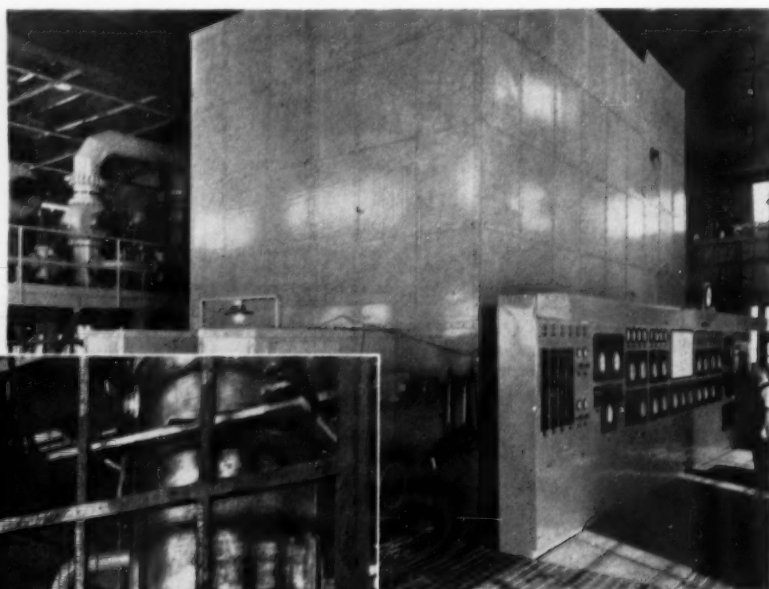
The furnace gas is water-scrubbed, and solid matter is removed from it before it is converted into liquid sulphur dioxide by Canadian Industries. The latter's operations involve drying the cleaned gas with sulphuric acid, then compressing and cooling it to condense the sulphur dioxide. Using gas from this furnace and other Inco smelter units, Canadian Industries in 1954 produced approximately 70,000 tons of liquid sulphur dioxide for the Canadian sulphite-pulp industry, as well as about 65,000 tons of 100-percent sulphuric acid.

Inco's flash-smelting furnace is 68 feet long, 24 feet wide and 17 feet high at the ends, outside its steel casing. It has a capacity of about 1000 tons of dry, solid charge daily.

The source of oxygen is the air we breathe, which contains around 21 percent of it. When air is liquefied, the components can be separated by distillation because they boil or vaporize at different temperatures (nitrogen at -196°C and oxygen at -182°C). Under the basic process by which this is done and as originated by Linde in Germany in 1902 and developed slightly later by Claude and Heylandt in France, the air is compressed to approximately 3000 psi, deprived of some of its heat and expanded to produce an additional cooling effect.

IT'S COLD INSIDE

The main liquefaction equipment is inside the large casing in the view at the right. The top sections of some of the 35-foot-high vessels it contains are pictured below as they looked during erection and before they were sheathed with mineral wool and boxed in. Ten carloads of the insulating material were required for the plant.



The resultant liquid is then distilled in a fractionating column.

Oxygen made in this way is about 99.5 percent pure, but it is costly. Much of the expense is incurred in obtaining the final pure fractions, but high-purity oxygen is required or preferred for most of the traditional uses of the gas. In the 1920's Mathias Frankl, a German, modified the method and made it possible to produce oxygen of 90 to 95 percent purity at considerably lower cost. The Germans used his system during World War II to provide oxygen for some of their surprise missiles and for industrial operations connected with armament manufacture.

The Frankl process permits the application of initial pressures not exceeding 90 psi, and even lower ones if the purity of the product is further reduced. In place of the tube-and-shell heat exchangers that had always been utilized for cooling the incoming compressed air with outgoing cold gases, Frankl introduced coolers of the regenerative type. By filling a vessel with stacks of disk-like assemblies made of thin, corrugated strips of aluminum twisted together in such a way that the ridges cross each

other, a great many minute and intricate passageways are provided. By this arrangement it is possible to expose 1200 square yards of surface within a vessel having a volume of not more than one cubic yard.

With this apparatus the temperature difference between the gas being cooled and the one doing the cooling can be reduced to within the range of 1-2 degrees, as against 6-8 degrees in tubular exchangers. Moreover, the pressure drop of the air in passing through the cooler is only one-third to one-fifth that in tubular units. In the Linde high-purity cycle, impurities in the air such as water vapor and carbon dioxide are removed by chemical means, but by the newer process they are deposited on the regenerator surfaces. These incrustations are later evaporated and carried out in the final product gases. The regenerators for nitrogen and oxygen are in pairs, and only one of each set is used at a time. While one is cooling entering air, the other is being cooled by outgoing gases. The flow through them is reversed at regular intervals of approximately $2\frac{1}{2}$ minutes.

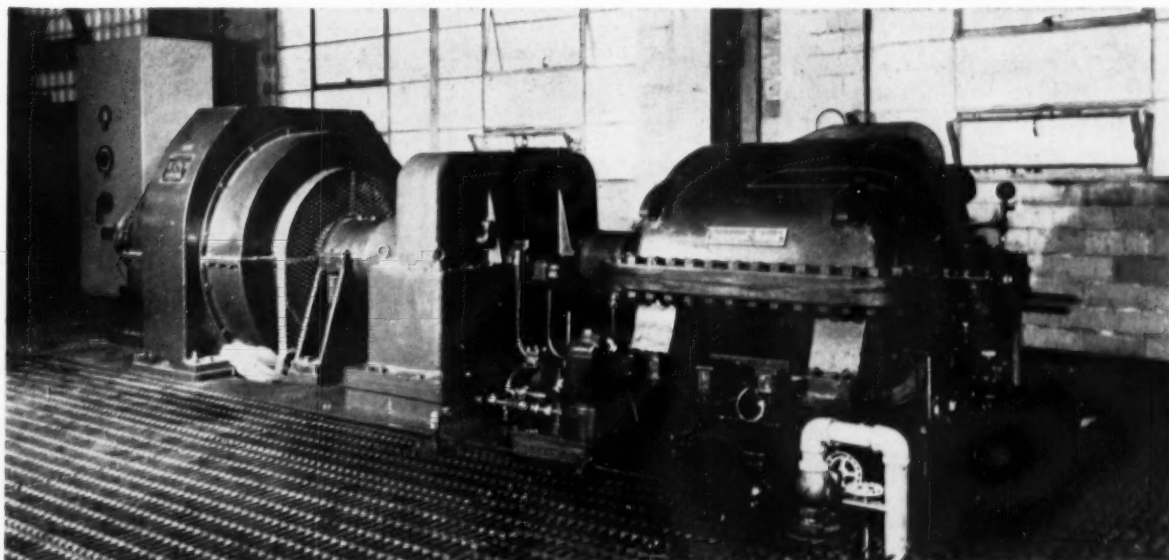
Linde in Germany and L'Air Liquide,

of Paris, both began to erect plants incorporating the new features. Canadian Liquid Air Company, which built the Inco unit, is an affiliate of the French concern, which was established more than 50 years ago to develop processes based on the patents of Georges Claude. The Canadian division was founded in 1912 and now produces air-derived industrial gases in nineteen plants located in all of the Dominion provinces but one. It also designs and constructs, to order, large-capacity plants such as the Inco Oxyton.

All commercial oxygen consumed on this side of the Atlantic up to 1948 was of the high-purity kind made by the older method. But since then the new technique, with minor modifications in some instances, has been applied by several processors of atmospheric gases in so-called tonnage plants, and the favorable cost has led to a considerable use of oxygen in the steel and chemical industries of the United States.

In the Inco Oxyton the air is compressed to about 66 psi by two Ingersoll-Rand 4-stage turboblowers arranged in tandem as a single unit and having an inlet capacity of 31,100 cfm. One blower, with a 77-inch casing, serves as the low-pressure section and the other one, which has a 65-inch casing, acts as the high-pressure end. An intercooler between them functions in the same manner as that in a conventional 2-stage reciprocating compressor. Through the medium of speed-increasing gears, the two blowers are driven at 4334 rpm by a General Electric 6000-hp, 720-rpm synchronous motor located between them.

About 3 percent of the air compressed is boosted to a pressure of 150 psi in another centrifugal machine. The remaining 97 percent goes directly to the



OXYGEN COMPRESSOR

An average day's output of the Oxyton is $7\frac{1}{2}$ million cubic feet, enough to fill 32,000 standard cylinders in which the gas is normally marketed. It is blown by the Ingersoll-Rand turboblower shown through 6000 feet of overhead 16-inch pipe to the smelter where it is used. This is a 4-stage ma-

chine with an inlet capacity of 6375 cfm. It discharges at 26 psi pressure and is driven at 7900 rpm through speed-increasing gears by an 800-hp motor. The interior of the blower is of special design and construction and includes nonsparking metal.

regenerators, where it is cooled almost to the dew point by counterflowing streams of nitrogen and oxygen from the fractionating unit. It also deposits its carbon dioxide and moisture contents. Upon leaving the regenerators, the air

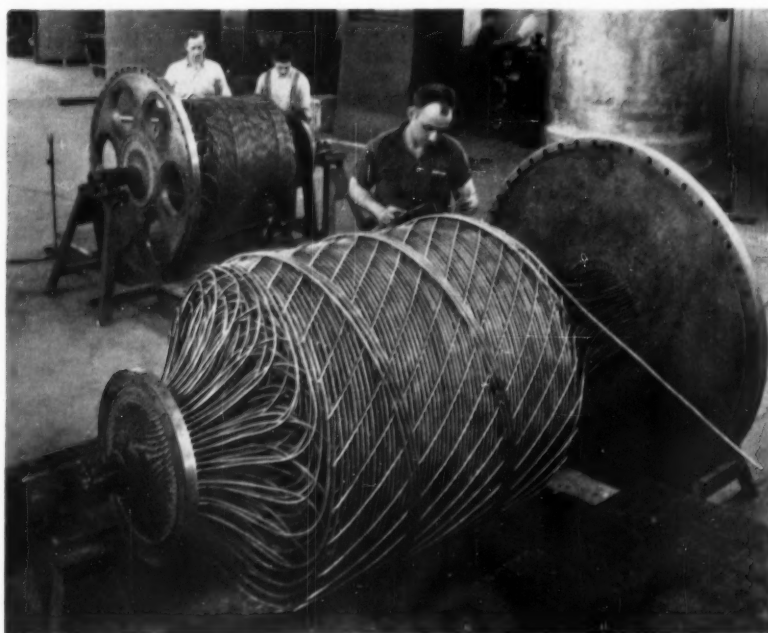
goes to the first or high-pressure column of the fractionator, where it is joined by the 3 percent of higher-pressure air from the booster. The air is distilled in three stages, each time at a progressively lower pressure. At each stage the purity

of the oxygen is increased. The products of the third stage are gaseous oxygen of the desired purity and gaseous nitrogen.

The nitrogen coming from the first column of the fractionator passes through exchangers, where it cools and partly liquefies the stream of air from the booster. Then the nitrogen, which has been somewhat warmed in the meantime, is expanded almost to atmospheric pressure in a turbine to supply the additional cooling effect needed to keep the process operating. There are two of these turbines, and both are used when starting up in order to accelerate cooling and thus shorten the time required to reach full production. After that only one is needed.

The oxygen, in gaseous form, is blown 6000 feet to the smelter through a 16-inch overhead pipeline by a third I-R 4-stage turboblower, which has sufficient capacity to compress 6375 cfm to a discharge pressure of 26 psi. It is driven at 7900 rpm through speed-increasing gears by an 800-hp motor that runs at 1200 rpm.

Working temperatures in the Oxyton range from plus 80°F to minus 280°F. Because most ferrous metals become increasingly brittle as the temperature drops, the regenerators are made from special $8\frac{1}{2}$ -percent nickel-steel that was developed by Inco for frigid applications. The regenerators, which are of welded construction, are notable for their large size, those for nitrogen being 8 feet in diameter and 17 feet long and the pair for oxygen 4 feet in diameter and $14\frac{3}{4}$ feet long.



BUILDING COIL HEAT EXCHANGERS

Each of these heat exchangers contains 400 copper tubes wound in coil form and enclosed in steel shells. Very cold gaseous nitrogen circulates between the inside walls of the shells and the tubes and further cools the liquid air that passes through the coils.



HOW ORE IS HANDLED

Above is the adit portal, the 24-inch-gauge track and, at the left, a compressed-air locomotive with a car of ore. The lean-to behind them houses a Gyro-Flo 600-cfm compressor, the largest of three Ingersoll-Rand units at the mine. The ore is dumped onto a screen beneath the adit level (below) where material less than $\frac{1}{2}$ -inch in size is eliminated. The remainder is sprayed clean so that sorters alongside a conveyor belt can easily pick off lean ore and rock as the material passes by. Sorted ore continues by belt to one of two 100-ton storage bins (right). Underneath the one shown is a truck being loaded for the trip down the mountain.



CHROME FROM ALASKA

The Star Four, Sole Producing Mine, Is Shut Down
Eight Months of the Year by Adverse Weather

ALLEN S. PARK



LOCATION MAP

The Red Mountain chrome deposits are near the southern tip of the Kenai Peninsula about 90 miles from Seward. No roads lead into the area, which is reached by boat from Homer to Seldovia, across Kachemak Bay, or by airplane to Seldovia.

IN A BLEAK Alaskan setting 2000 miles north of Seattle, Wash., by water, America's only high-grade chrome mine produces ore approximately four months a year. During the remaining months it is held inactive in the firm grip of the harsh Arctic winter. Called the Star Four Mine, it is owned by the Kenai Chrome Company, so named because the property is on the Kenai Peninsula. The manager is M.E. Seiler, who has been in Alaska for 23 years. The operation is a small one, employing about 30 men. Shipments of ore in 1955 amounted to 7067 short tons valued at \$552,000.

The mine is at an elevation of about 2600 feet near Red Mountain, a dominant peak in the Kenai Range, and is approximately 14 miles from Seldovia, the

closest town of consequence. It is accessible only by a steep, twisting one-way road that was built to take supplies up to the property and bring the ore down to a beach on the shore of Kachemak Bay, where the material is stockpiled until there is enough to fill a barge. Then it is loaded by means of a conveyor that travels on a narrow pier extending 150 feet into deep water. The pier is necessary because the tide runs 24 feet in the bay. The barge is towed to a Puget Sound port where the U.S. Government accepts the ore. In 1955 two bargeloads constituted the season's shipment. For several years the company has been working on a road from the mine to Seldovia where docking facilities for boats are available. About 7 miles, or half of it, has been completed.

The Red Mountain District is one of two areas on the Kenai Peninsula where chrome ore is found. The other one is at Claim Point on the coast and some 30 miles southwest of Seldovia by air. A report on the deposits was made by the U.S. Geological Survey in 1910, following a trip to the region in 1909 by U.S. Grant of its staff. Under the stimulus of

wartime high prices, 1000 tons of ore containing 46 to 49 percent chrome oxide was mined at Claim Point in 1917 and an equal quantity averaging 40 percent chromic oxide was produced in the succeeding year. At the end of hostilities the price plummeted and operations were abandoned.

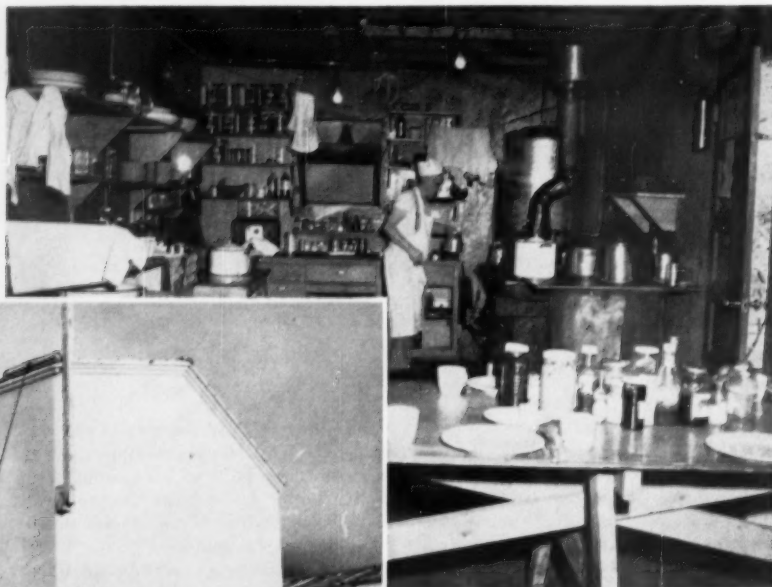
In 1941 the Geological Survey conducted further investigations under the provisions of the Strategic Minerals Act passed by the Congress. Philip W. Guild visited the section that year and wrote a bulletin (931-G) that was published in 1942. He determined that the more important and largest deposits were in the Red Mountain District. Reserves there were estimated at 67,500 tons of chromic oxide in ore rich enough to warrant shipment as mined, plus enough material of lower grade to yield 51,000 tons of chromic oxide if concentrated. At



THE RED MOUNTAIN ROAD

The road (right) does a lot of winding as it descends. In the background is a typical glaciated valley of "U" section. There still remains an icecap a few miles away. Strictly a one-way route, no truck starts down while another is going up in order to avoid trouble in passing. A truck that "didn't make it" is shown above. It spilled ore worth \$680 when it failed to negotiate a turn, but the driver jumped and was not hurt.





MOORED AGAINST GALES

To prevent the mine buildings from taking off during winds of gale force they are not only anchored with cables that pass over them but also shored up with timbers. There are plenty of simple comforts inside. The most popular place is naturally the cookhouse, presided over by George Hagen, right.

Claim Point the approximate quantities in these two categories were 5600 tons and 26,500 tons, respectively. The total for the two areas was set at 150,000 tons of chromic oxide.

At the time of Guild's visit the Red Mountain District could be reached only by a narrow trail. It had to be negotiated on foot, as no pack animals were available. He found some 30 deposits of varying sizes of which only three were covered by patented claims that had been filed in 1918 by two men named Lass and Whitney. In addition, 23 unpatented claims had been staked in 1940. He estimated that about 42 percent of the ore in sight was in the Star No. 4 Claim, which was one of the three that had been patented. The ore there could be traced on the surface for about 1000 feet. The only attempt that had been made to explore it was an inclined pit 11x5 feet in section and about 6 feet deep. It is this property, with its name slightly changed, that is now being worked. It represents the only current chrome-mining activity on the peninsula or, for that matter, in Alaska.

The ore exists in masses of ultramafic rocks (those with large contents of magnesium and iron) that were intruded into a complex series of graywackes, slates

and cherts laid down as sediments in perhaps the Paleozoic geological era. The host rock is dunite, a magnesium-iron silicate commonly containing grains of chromite (iron-chromium oxide) that are distributed through it. In this case the chromite content amounts to about one percent, but in some places it has been concentrated. These are the ore deposits. They are in the form of lenses or bands that range from mere streaks to bodies 1 to 50 feet thick and several hundred feet long. The proportion of chromite in them ranges from 90 percent downward.

As accompanying pictures show, the dunite is characterized by banding and jointing. Banding is so conspicuous as to give the igneous rock a stratified appearance. The soil that results from weathering of the dunite is infertile, so there is no vegetation to hold it and it is washed away as fast as it is formed. At the bases of the cliffs are great slopes of talus spalled off from above. Red Mountain stands out sharply because of its baldness, and the formation of iron oxide during weathering of the dunite gives it a red or yellow cast.

Kenai Chrome Company bought the property from Union Carbide & Carbon Corporation, which had acquired it in the early 1940's from Red Mountain

Chromite Corporation. The latter concern had tried for two or three years to develop a mine, but eventually gave up, apparently considering the elements too much to cope with. Union Carbide never actively worked it.

The present owner began operations in July 1953. The first summer was devoted to rehabilitating and extending the road to the mine, erecting buildings, procuring and installing equipment. Development work continued in the following summer with production starting in August, and by late October an aggregate of 2600 long tons had been shipped. Last year was the first one of full-capacity effort. The 1956 output is expected to surpass slightly the 7067-ton total of 1955. A shipment of approximately 4000 tons reached Everett, Wash., early in September and a second one will be made towards the end of October.

Operations at the Star Four begin as soon as the winter's snow has melted sufficiently. The exact time is indeterminable, but it is usually around July 1. Someone is sent up in advance to open up. Storms usually end the work about November 1. Everything is then closed and battened down tight, and all hands leave until the next summer. Abnormally bad weather curtailed 1955 activities to even less than four months.

Access to the ore is gained through an adit. Power for the drills is furnished by three Ingersoll-Rand portable compres-

sors. A 600-cfm Gyro-Flo has been converted into a stationary unit and is the primary source of supply. Two 210-cfm machines are moved around underground to supplement the air delivered by the main unit, as may be required.

Drilling is done with Ingersoll-Rand JR-38 Jackdrills provided with telescopic legs for horizontal work in drifts and crosscuts or with 30-inch stoper feeds for putting in overhead holes. Scrapers for transferring and loading the ore and waste are powered by I-R 25-hp double-drum air hoists. Hauling is done by an Eimco compressed-air locomotive be-

cause no electricity is available other than that produced by a diesel engine-generator set for lighting the bunkhouse, cookhouse and other buildings. Cars are of 1 1/4 tons capacity.

At the adit portal, ore is screened to eliminate material under 1/2-inch size. The remainder is carried to bins by a conveyor belt along which workers are stationed to pick out waste rock or ore too lean to warrant shipment. To make their task easier, the ore is washed, thus removing fines and presenting clean surfaces for inspection. The sorted material goes to either of two 100-ton storage bins,



MINE MANAGER

M.E. ("Mike") Seiler, left, manager of the operation, talks with Russell Johnson who visited the mine with his wife so that she could take pictures to illustrate this article.



NOTHING GROWS HERE

Shown at the top is dunite, a tabular, much-jointed rock that comprises 90 percent of the Red Mountain area. Named for the Dun Mountains in New Zealand, where it was first found, it is a variety of peridotite consisting essentially of olivine—a silicate of iron and magnesium—and chromite, an oxide of chromium. Where the chromite has been concentrated there is ore. No trees grow in the soil derived from the dunite, so all timber has to be hauled up from below. But there is abundant water from melting snows, and it forms numerous lakes in hollows scooped out by glaciers. From the one shown water is pumped to the mine for washing ore.

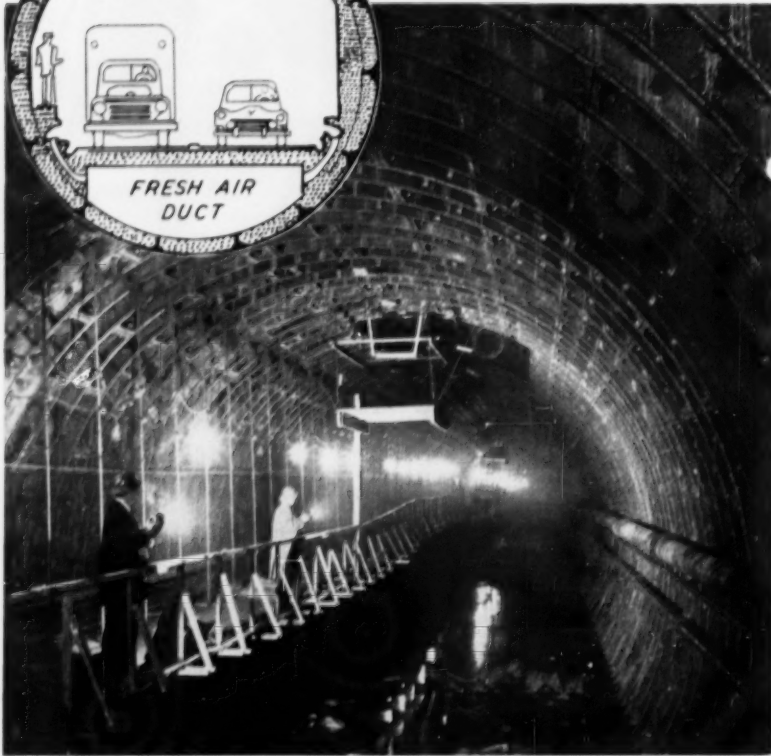
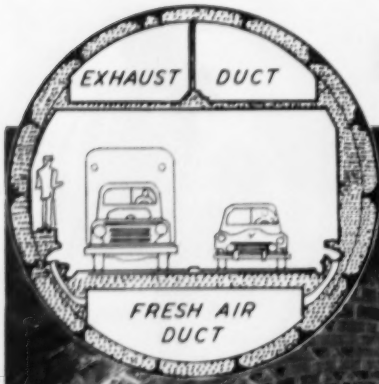
from which International trucks are filled for the descent to the barge loading base on the beach.

The ore, as shipped, is classified as to metallurgical grade, which means that it has a chromic-oxide content of at least 42 percent and a minimum chrome-to-iron ratio of 2 to 1. Lump ore delivered so far has averaged 46 percent in chromic oxide, with a chrome-to-iron ratio of 2.8 to 1. It exceeds in purity the raw material from any of the relatively few chrome deposits known in the United States. Normally, we obtain most of our supply from Rhodesia, Turkey, New Caledonia and Cuba.

Chrome ranked high among strategic materials during World War II, being one of four minerals that constituted the first-priority group of reserves to be stockpiled. Our consumption during the emergency was around 600,000 tons a year, of which three-quarters went to the steel industry. It imparts strength and corrosion resistance to steel, creating an alloy that is important in manufacturing armor and armor-piercing projectiles. The layman knows chrome best in the forms of stainless steel and plating on the trim of automobiles. In its chemical combinations it is also used in refractories, in the dyeing, tanning and pigment industries, in metal-pickling solutions and as a catalyst. Metallurgical grade ore is now quoted at around \$110 a ton.

Kenai Chrome Company is a partnership owned by John G. Bachner and Manager Seiler. Karl A. Bachner is assistant manager and Norman Crooks is mine foreman.

LINCOLN TUNNEL THIRD TUBE PART 2

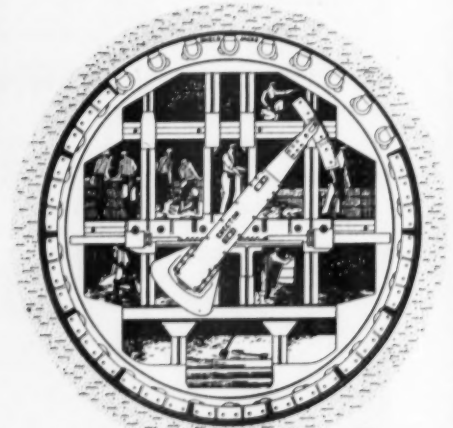


TUBE SKELETON

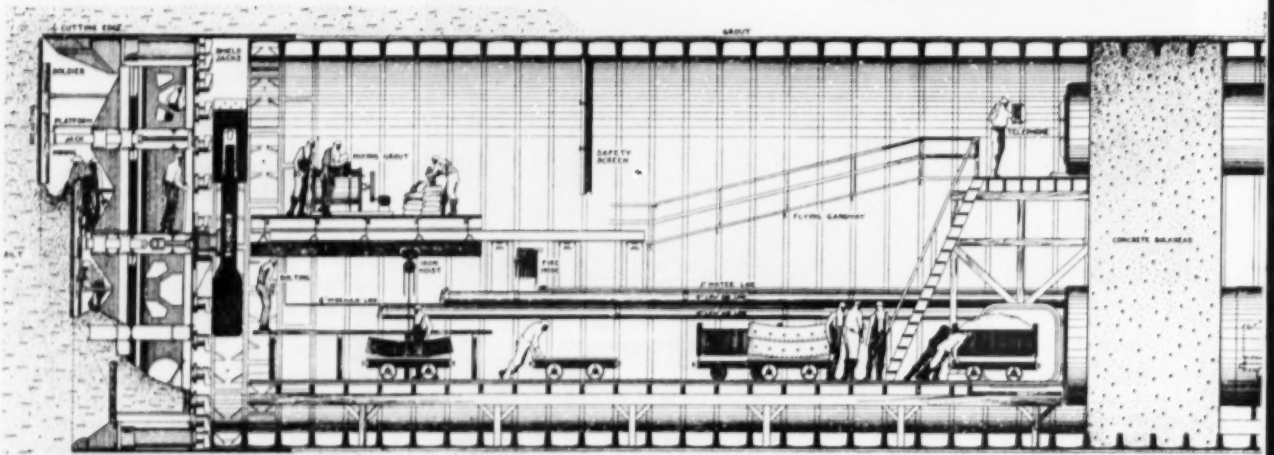
Casing of cast iron (above) with silt ballast, taken in through the advancing shield, covering the bottom. On the hanging platform at the left are the walkway and railway running to the heading. Compressed air, water and hydraulic lines are carried along the right side. The inset shows the cross section of the completed tube of which approximately 40 percent will be hidden from the view of motorists.

SUBAQUEOUS TUNNELING EXPLAINED

These drawings, prepared by The Port of New York Authority, show the equipment and typical operations involved in driving the Third Lincoln Tube. There are minor differences in the facilities as pictured and as actually installed; for example, the man lock was at a lower position in the bulkhead than indicated in the large sketch.



REAR OF SHIELD
ERECTION OF IRON & MUCKING IN PROGRESS



LONGITUDINAL SECTION THROUGH TUNNEL HEADING SHOWING CONSTRUCTION OPERATIONS

tural members. Attached to the forward framework were two hydraulically operated gates that could be opened to admit muck during a shove. It was the first tunneling shield of all-welded construction; previous ones were largely bolted or riveted. The bare shield weighed 240 tons, which was increased by 30 tons when the jacks, erector arm for handling the lining segments and other equipment were added.

Being too big to be lowered in one piece through the Weehawken shaft from which it was to start its trip, the shield was broken down into nine sections that could be handled by the derrick at the top. Before it was assembled, however, the tunnel was driven a short distance through the rock by conventional methods. The shield was moved into this opening, and on November 9, 1954, its jacks made their first push against ten rings of lining temporarily erected in front of a 30-inch concrete wall at the base of the shaft.

Tunneling continued toward the river in dry shale, and during that period miners, working well in front of the

shield in free air, drilled and blasted the rock, which was brought back through the shield, up the shaft to the bridge and trammed to its opposite end for disposal. After the heading had reached a point beyond the eastern end of the bridge a second shaft 30 feet in diameter and 60 feet deep was sunk there to intercept the tunnel and was equipped with two independently operated cages serviced by a 2-drum electric hoist. This ended the necessity of using the bridge as a means of access and muck disposal, and thereafter lining segments and other materials and supplies were sent below through the second opening. Underground haulage was done with storage-battery locomotives.

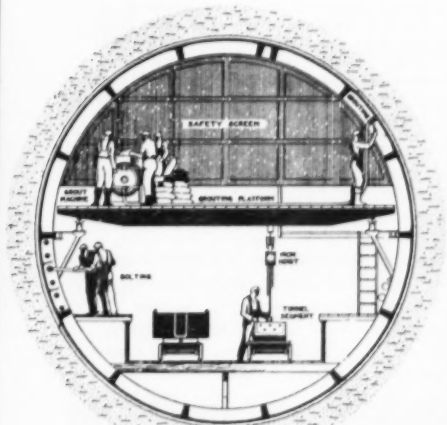
About 100 feet eastward of the second shaft was erected a concrete bulkhead 11 feet thick to "cork" the tube so as to confine the compressed air that was soon to be admitted and thus keep the workings under sufficient pressure to exclude silt and water. Three steel air locks extending through the barrier were encased in the concrete, which was delivered through a pipe line from outside by a Pumpcrete unit. Air, hydraulic and utility lines also passed through the bulkhead.

The man lock, 6½ feet in diameter and 34 feet long, had facing benches on

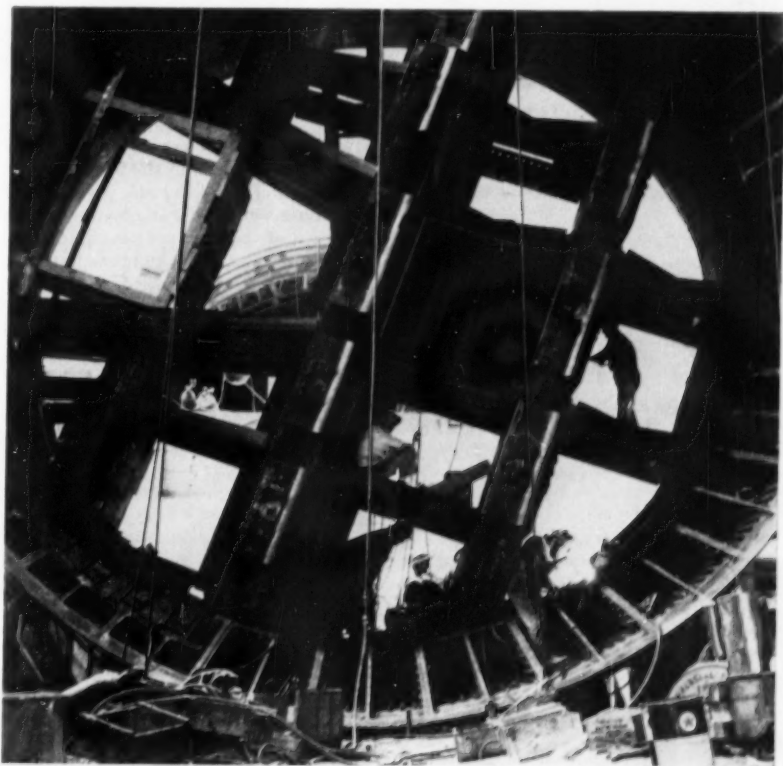
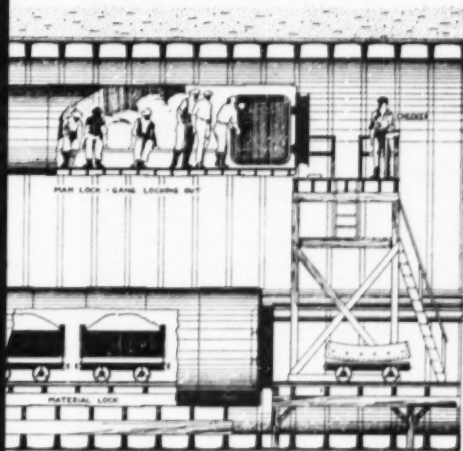
which up to 40 men could sit while undergoing pressure transition for a prescribed period when passing in or out. A materials lock, at track level, was 10½ feet in diameter and 39 feet long. Near the top of the bulkhead, where it would remain accessible for a considerable length of time should the tube become flooded, was a 5x20-foot emergency lock. There was fortunately no occasion to use it as an escapeway, but it was used regularly by the surveyors when running their lines to keep the shield on its course.

By January 18, 1955, the shield was moving out of the solid shale into the river silt which, in New York Harbor, has all the characteristics of a fluid. It has been described as an extremely fine dust supersaturated with water. The particles are so small that Portland cement is coarse by comparison. The air was then turned on and remained on until the river crossing was completed. Pressure was maintained at around 15-16 psi until the latter stages of the shield's trip, when it was increased for a short time.

For the next year the cycle of operations—shove ahead and erect lining—became somewhat of a routine affair, with progress about as had been expected. As the days passed, more and more of the 2032 rings called for were

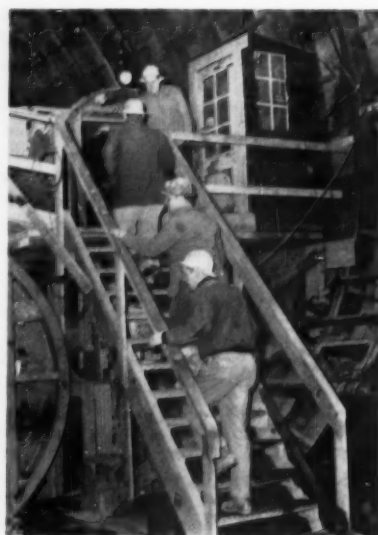
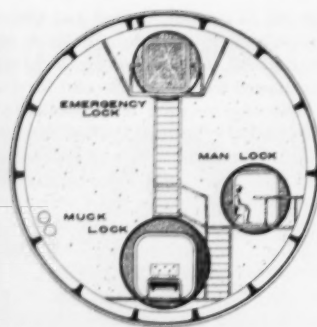
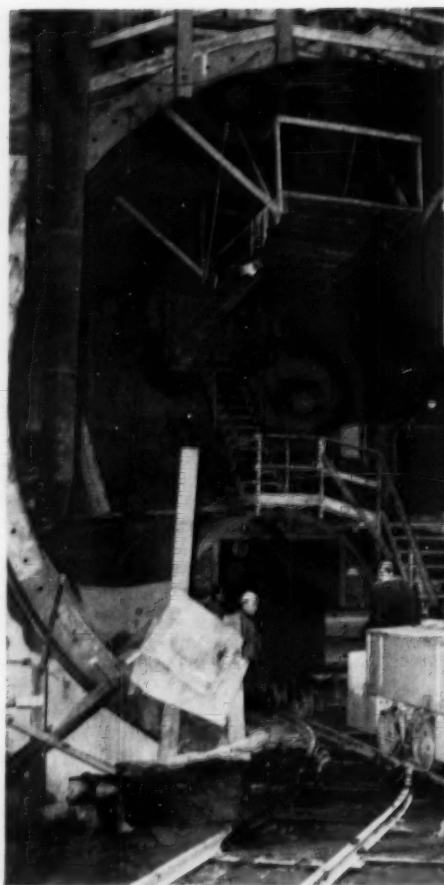


VIEW FROM REAR OF SHIELD
BOLTING & GROUTING IN PROGRESS



SPEARHEAD OF SHIELD

The 240-ton shield was lowered to its starting point in the New Jersey shaft in nine pieces. This picture shows the front of the monster, with its 31½-foot cast-steel cutting edge, at the time of assembly. The complete shield was 18 feet long.



AIR LOCKS AND SAND HOGS

Extending through the concrete bulkhead erected near the New Jersey shore were three air locks (left) disposed as illustrated in the sketch. Air lines to keep the bore ahead of the bulkhead under pressure are shown entering at the left, below center. The sand hogs climbing the stairs, above, were about to be "locked in" to the higher pressure beyond. Each gave up his identification badge as he entered, got it back when he came out. Locking out, that is, decompressing the body to atmospheric pressure, required about eight minutes. Men between 20 and 50 years of age made up the working force.

pieced together by the 200 sandhogs who worked six hours a day—three hours on, three hours off, three hours on—six days a week.

Each ring has an outer diameter of 31 feet, weighs 44,000 pounds and is composed of fourteen uniform segments, plus a smaller one that serves as a key or locking unit. The larger segments are each 83 inches long, 32 inches wide and 14 inches deep. After they were fastened together and to the last-erected ring by high-tensile steel bolts, the joints were calked with lead, using air-powered tools. More than 30,000 segments entered into the lining between the two shafts. These were supplied by Bethlehem Steel Company at an outlay of \$10,620,971. A total of 298,000 bolts $8\frac{1}{4}$ inches long and $1\frac{3}{4}$ inches in diameter, an equal number of nuts and 796,000 washers were needed to connect them and were produced by Pittsburgh Screw & Bolt Corporation at a cost of \$491,849.

In erecting a ring, a mechanically operated arm picked up each segment, in turn, and positioned it for bolting. The arm was attached to the rear of the shield framework and pivoted at the center. In most previous tunnels, bolts were tightened with long-handled wrenches wielded by two men, but this work is

now done by an air-powered mechanism that was developed on the north tube of the Lincoln Tunnel in 1941. In the third tube, nuts were first run on snugly with a wrench of the type used in laying railroad track and then tightened with a bolting machine—a long steel arm that was moved around an inner circular I-beam track by two Ingersoll-Rand close-quarter air drills. In this manner an I-R Multi-Vane drill, mounted at the outer end of the arm, traveled around the inner circumference of the lining ring and tightened the nuts to a uniform tension of 50,000 psi.

After a ring had been erected, the rams of the 28 jacks were extended horizontally, pressing against its forward face and pushing the shield ahead 32 inches. Another ring was then placed and secured and another shove made. Approximately four-fifths of the silt in the shield's path was thus pushed aside, only enough being admitted to the tube to overcome its natural buoyancy. Experienced sand hogs in the fore part of the shield opened the hydraulically operated gates and allowed controlled amounts to ooze in. This material was spread along the bottom of the tube to remain as ballast until just before the concrete lining was poured. The shield

reached the state line between New Jersey and New York, about midway of its trip, on October 5, 1955. At this lowest point its floor was 97 feet below water level. Throughout most of the crossing there was about 25 feet of silt between the top of the shield and the river bottom.

Although the shield made its way through the silt without encountering any unusual difficulties, some minor trouble affecting the final stages of its trip developed on the New York shore. There the contractor was driving an auxiliary tunnel—a 15-foot-diameter drift—westward from the Manhattan shaft on the tunnel line toward the advancing shield. It was in rock and was to end a safe distance short of the junction between rock and earth. Rails were to be laid in it on which to run a cradle that was to be made ready to receive the shield when it reached that point. The shield was then to continue its journey behind the rock drillers as they worked back to the shaft, enlarging the drift to full tunnel size.

By January 25 of this year the drift had been advanced 96 feet and was nearing the limit of the rock formation. As a precautionary measure, a concrete bulkhead had been erected a few feet from the portal and fitted with a steel

door 6 feet high and 5 feet wide. At 4:20 that morning, while the fourteen men on the night shift were eating lunch at street level, water began to enter the workings. An alarm was sounded by a pumpman who had been left at the bottom of the shaft. Three of the workers returned to the drift and found the water 3 feet deep and rising rapidly. They tried to close the bulkhead door, but pipes and air hoses interfered. When the water got up to their necks they swam out to the shaft.

Water backed up in the drift and for one block eastward in the tunnel extension already excavated and partly finished in 38th Street. Some hours later a diver succeeded in clearing away the obstructions and attaching a cable to the door so that it could be pulled shut with power applied by a donkey engine on the surface. It was assumed that the water came from the river and entered the drift through a fracture or joint in the rock, or that it was ground water from the earth overlying the rock. After the bulkhead door was closed the water was pumped out and the remainder of the drift in rock excavated from west to east immediately in advance of the shield.

This project has established new safety marks for tunneling under air pressure. It also is producing the most complete set of records on safety aspects ever compiled on an undertaking of this sort. In its efforts to reduce or eliminate hazards, the Port Authority invested approximately \$200,000 and considers the money well spent. The safety drive included a workmen's compensation program that is usually handled by the contractors. The program is especially effective because of the coöperation given Vincent W. Mooney, the Authority's safety en-

gineer, by the men on the job, most of whom are members of the American Federation of Labor, Local No. 147, Compressed and Free Air Tunnel and Sewer Caisson and Foundation Workers of America. The union stewards were trained by Mooney and wear white hard hats that designate them as safety specialists.

Foremost among the safeguards for the workers' well-being is a \$60,000 medical clinic in the Mason-Johnson-MacLean yard on the New Jersey shore. In the 55x60-foot building are a decompression chamber and individual rooms containing X-ray, surgical and physiotherapy equipment and audiometer (hearing) instruments in addition to laboratories and offices. The medical facilities are considered to be as modern and complete as those in a small hospital.

The decompression chamber, need for which has now passed, has two compartments—one that was used for testing prospective sand hogs and one for treating cases of compressed-air illness or "bends." In the forward section of the 6x18½-foot lock are facing benches on which up to eight men could sit while undergoing tests to determine their physical fitness when under air pressure. To qualify, their ear drums and sinuses had to be able to withstand pressure without pain or injury, their bones and joints had to be free from disease and they had to have sound cardiac and respiratory systems. While they were under pressure a medical attendant outside observed them through a window above the door. During the examination the pressure ranged from 5 to 15 psi, and at the first signs of distress the applicants signaled and the air was shut off. There was also a telephone inside.

The rear section of the lock was re-

served for men affected by air pressure while on the job. A doctor or a nurse could reach it through the front compartment without disturbing the pressure within. A patient was usually put under double the pressure at which he was working before becoming afflicted. This relieved his pain, and the pressure was then reduced slowly enough for the removal of the bubbles of nitrogen—the source of the trouble—from the blood stream and expulsion through the lungs as he respired. Each section of the chamber had its own air-supply system, a maximum pressure of 70 psi being available.

The clinic is in charge of Dr. Samuel I. Kooperstein of the Port Authority's medical department and was staffed during the period the tunnel was under air by four doctors, three nurses and several medical technicians. All the doctors were given a preduity indoctrination course at the Navy Diving School, New London, Conn., in the effects of compressed air on the body. One doctor was on call Sundays and holidays, when work was suspended, to take care of any cases that might arise. Each sand hog wore a badge that designated his vocation and gave instructions to rush him to the hospital lock at the tunnel if found ill. This precaution, which is in effect on all compressed-air construction jobs, is necessary because the symptoms of "the bends" are similar to those produced by intoxication and hence capable of misinterpretation that might deprive an afflicted man of prompt and correct treatment.



ASSEMBLING LINING RINGS

Sand hogs, left, placing locking or key segment in position to complete a ring of lining prior to making another forward shove. The structural member extending upward in the center is the erector arm on the back of the shield that lifted the segments. Some of the bolts, nuts and washers used in assembling the 2032 rings are illustrated above. Each bolt is 8¼ inches long and 1¼ inches in diameter.

With the tube's skeleton in place, the interior remains to be finished. This involves clearing out the silt ballast and the miscellany of forms, materials and equipment that were required for the underriver journey, caulking the joints of the segmented rings, cleaning up their rusted surfaces, placing 14 inches of concrete lining, putting in the horizontal roadway and ceiling slabs, installing the ventilating ducts, facing the walls and ceiling with ceramic tile and installing the illumination system. When it is all done, the part that the public will use and see will represent about 60 percent of the total cross section. Much of the hidden spaces underneath and overhead will be utilized for ducts, piping, wiring and other necessary operating accessories.

Mason-Johnson-MacLean is doing the calking, cleaning and concreting. Ready-mixed concrete delivered to the portals is pumped through piping into the forms. After the circular lining has been placed, the roadway slab will be put in and, finally, the ceiling. Traveling carriages, on which are mounted appropriate hydraulically controlled retractable forms, will be used at all these stages, stretches of about 50 feet being concreted at a time. After the freshly applied material has hardened sufficiently to be self-supporting, the forms are moved ahead and another section is concreted. The job will require 35,000 cubic yards of concrete, or about 70,000 tons.

Ten-inch steel beams are being set transversely, 21 inches apart, and encased in 15 inches of concrete to form the roadway, which will measure 21½ feet from curb to curb and be divided into two lanes each 10 feet 9 inches wide. A 5-inch concrete slab will form the ceiling, which will allow 13 feet 7½ inches of headroom. Walkways will be provided along each side, with recesses at intervals. An innovation in lighting so far as New York tunnels are concerned will be

the use of continuous fluorescent tubing.

Tiling of the walls calls for 2½ million 4¼-inch squares turned out at the Canton, Ohio, plant of the U.S. Ceramic Tile Company and purchased by the Port Authority for \$231,416. They are being put in place by the Atlas Tile & Marble Works, Inc., of Long Island City under a \$1,078,980 contract. Machines to lay tiles have never been devised, and the work is done by artisans, many of them from northern Italy. An adhesive mortar mixture is troweled on the back of each one before it is put in position. Guide lines or wires to insure proper alignment of the joints are laid out in advance.

G.M. Crocetti, Inc., of New York City, has the contract to tile the ceiling. The tiles for this work arrive in long sheets, with the pieces held together by paper that also protects their faces. The sheets are laid on forms that are held in place by braces extending from the arched roof. The concrete slab for the ceiling is then poured on top of the tiles.

The ventilation system will be capable

of changing the air in the tube every 1½ minutes. Twenty-four fans in buildings at each end will blow in fresh air and withdraw foul air. Inflow will travel underneath the roadway and pass upward through regularly spaced openings; vitiated air will be drawn out through overhead vents, follow the passage above the ceiling to the portals and be exhausted to atmosphere at the tops of the ventilation buildings and high above ground level. The latter are duplicates of those now serving the existing tubes. Constructed of steel-and-masonry, each is 107 feet long, 61 feet wide and 150 feet high. James Mitchell, Inc., built the one at Weehawken and Colmar Construction Company the one in New York. Each cost more than \$1,000,000.

M. L. MacLean is project manager for Mason-Johnson-MacLean, George L. Sager is general superintendent and Hugh E. Cronin is job engineer. Howard L. King, vice-president and chief engineer of Mason & Hanger and recognized as one of the foremost authori-



CEREMONIES MARKING PROGRESS

When the shield reached the New Jersey-New York boundary 2677 feet from the starting point on October 5, 1955, brief ceremonies were held at the New Jersey end. The picture at the left shows two of the segments for the transition ring, No. 1005, on a car about to be pushed aboard the cage for its trip down the shaft. From left to right on the car are Donald V. Lowe, chairman of The Port of New York Authority; Howard L. King, chief engineer of Mason & Hanger, consultant; John M. Kyle, chief engineer for the Port Authority; and Austin J. Tobin, Port Authority executive director. "Holing through"—arrival of the shield at the New York construction shaft—on June 28 of this year was observed underground with speech-making and tightening of the final bolt in the tube casing by Governors Robert B. Meyner of New Jersey and Averill Harriman of New York. Above, with the shield as a backdrop, Governor Meyner is shown at the microphone.

ties on shield tunneling, is consultant. For The Port of New York Authority, John M. Kyle is chief engineer and L.F. Booth and H.G. Dedancq are engineers in charge of all construction. Resident engineers are Joseph Gavin at the New York end and H.A. Druding at the New Jersey end and the river tunnel.

Donald V. Lowe of New Jersey is chairman of the Port Authority commissioners and Eugene F. Moran of New York is vice-chairman. Howard S. Cullman of New York, who has served continuously since being appointed to the group by Gov. Alfred E. Smith in 1927 and who was chairman for ten years,

was made honorary chairman in May 1955. Other commissioners are: Horace K. Corbin, Jess Harrison Davis, Dow H. Drukker, Jr., James C. Kellogg III and Thorn Lord, of New Jersey; S. Sloan Colt, Charles S. Hamilton, Jr., Chas. H. Sells and N. Baxter Jackson, of New York.

PART 3

Three of the Low-pressure Compressors Served on Their Sixth Subaqueous Tunnel Job in New York

AS IS true of all subaqueous construction jobs, some of the most important mechanical equipment on the Lincoln Tunnel third tube has been behind the scenes, out of sight. In this category are the compressors—those that kept the tube under pressure and others that furnish air for labor-saving tools—and the hydraulic pumps that supplied the fluid pressure to operate the shield jacks. These units are located in a metal-sided building in the contractor's yard adjacent to the Weehaken shaft.

If air compressors could talk, some interesting tales would undoubtedly come from three of the four Ingersoll-Rand low-pressure machines installed there. For 24 hours a day, month after month, the four units protected the sand hogs as they pushed their way along, charging the slowly lengthening tube with just enough air to prevent the entrance of muck and water from the river.

For three of the compressors this was an old story, because this is the sixth tunnel they have helped to drive under the waterways around Manhattan Island. They belong to a family of eight, all but one of which can still be accounted for. Of identical size and design, the eight came out of Ingersoll-Rand's Phillipsburg, N.J., factory in 1927 and were delivered to Mason & Hanger, Inc., the contracting firm that has built more of New York's subaqueous bores than any other concern. The period was one of great subway expansion in Gotham. The Independent Line was underway, and the IRT and BMT systems were being extended (the three have since been united). Contracts covering \$47 million worth of work had been let in 1926 and 9700 men were engaged in carrying them out.

The compressors went to work for Mason & Hanger on the East River subway tunnel between Fulton Street, Manhattan, and Clarke Street, Brooklyn, and remained there three years. At each end was a powerhouse containing four machines which remained together and under Mason & Hanger ownership for another eight years, making eleven in all. Meanwhile, they served on two more tunnels. The first one was the subway link from Pike Street, Manhattan, to Jay Street, Brooklyn, 1931-33; the second job was the first Lincoln Tunnel tube, 1937-38. On both of these assign-

ments the compressors were also divided, four at each end.

The group was broken up when some of the units were sold to Walsh Construction Company for service in driving the Queens-Midtown Tunnel between Manhattan and Queens boroughs in 1938-40. The separation was temporary, however, for as soon as that mission was completed Mason & Hanger bought them back for use, with the others, in sinking caissons required to place the foundation of the

Lackawack Dam, one of the structures in the Delaware River water-supply system of the City of New York. Actually, one of the eight was missing for good at that time, having been sold in 1938 to a glass factory in Indianapolis, Ind.

The machines next saw service on the Brooklyn-Battery vehicular tunnel that runs from the tip of Manhattan Island under the bay to Brooklyn. Mason & Hanger utilized three of them in driving the twin tubes from the Manhattan end



ON JOB LONG TIME

Ernest Lange making an adjustment on one of the compressors that have been under his care and supervision for 30 years. During that entire period he has worked for Mason & Hanger, which has built more of New York City's subaqueous tunnels than any other contracting firm.

and sold four to George H. Flinn Corporation, contractor on the opposite end. Although ground was broken in 1940 and underwater work begun in 1942, the job was not completed until 1949. The War Production Board closed it down for 2½ years in October 1942 because of the wartime shortage of steel. Later, after the shields were well advanced, tunneling was suspended several times by strikes, but it was necessary to operate the compressors in order to keep water out of the tubes. When the Flinn machines were no longer needed, the firm sold them to George F. Driscoll Company which used them between 1948 and 1952 on sewer construction work in Philadelphia.

Having disposed of five of the original eight units, Mason & Hanger had only three when it became a partner in the third Lincoln tube project. Actually, one or two compressors could have maintained the required pressure, but on undertakings of this nature extra capacity is always provided as a safety measure to meet possible emergencies. Consequently, four machines were stationed in the Weehawken powerhouse. The one needed to round out the number was obtained from California where it had been dispatching gas to householders for many years. It is of the same model and size as its three companions and about the same age.

The compressors, which are designated as Class PRE, are of the horizontal, duplex, single-stage type with two cylinders each of 29-inch bore and 21-inch stroke.

Each unit has a piston displacement of 5400 cfm and is driven by a General Electric 625-hp synchronous motor. Two 12-inch air lines ran into the tunnel, although only one was normally required. At the point where they emerged from the building there were valves to control the flow and a large pressure gauge facing a chair where a man sat all the time ready to spin the wheels in order to increase the volume of air if the gauge should show a sudden drop in tube pressure. Fortunately, the tunnel was a "tight" one, and with expert supervision and well-trained workers "up front" in the shield the valve tender's job was a sinecure.

It is rather unusual for compressors to remain together so long in the construction industry. Even more remarkable, perhaps, is the fact that they have always been in charge of the same man. He is Ernest Lange, a resident of Teaneck, N.J., who came to Mason & Hanger with the original eight machines and has been with the company ever since. Needless to say, he is much attached to his job, his bosses and the compressors.

Lange, who is past 70 years of age, worked as a machinist at the Rand Drill factory in Tarrytown, N.Y., more than half a century ago before the merger that created Ingersoll-Rand Company. After a while he was put "on the road" as an erector of the first direct-connected motor-driven compressors placed on the market. He set one up for Murphy & Caffrey, the contractor that was building the Pennsylvania Railroad terminal

in New York City in 1915. His brother happened to be superintendent on that project and offered him a job looking after all the mechanical equipment. (Lange recalls that he was getting 24 cents an hour but said he was being paid 30, and was thrilled when his brother offered him more.) He was hired and remained about 3½ years—until the contract was completed, then he started erecting machinery for anyone in need of his service. He installed the eight compressors for Mason & Hanger and stayed on to run them.

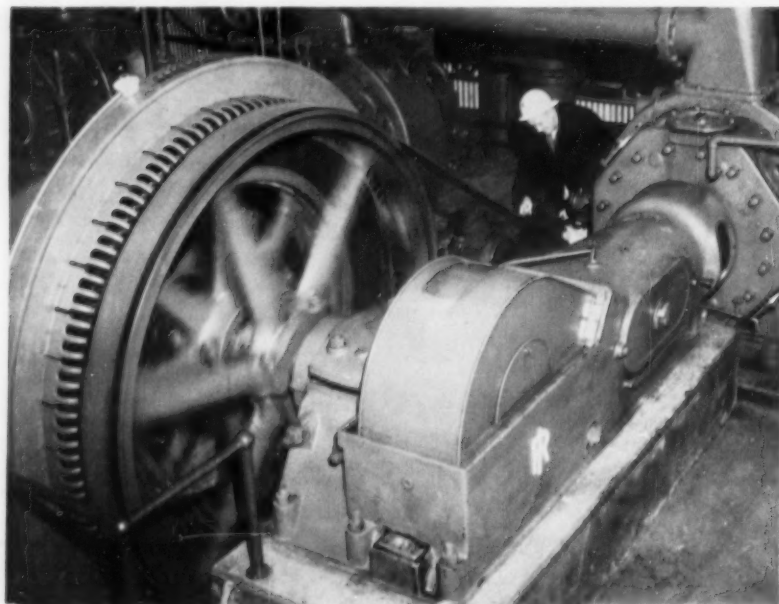
Few operators know more about the machines in their care than Lange does about his, and few machines get better attention than he gives them. When Mason & Hanger has compressed-air work underway he forgets about vacations. Between jobs, he goes over the machines carefully, making them ready for their next stint of safeguarding the safety of men toiling in a charged-up tube under a river. Nothing serious has ever happened to the compressors, and the only parts he has ever replaced are valves, which are made better now than they were when the units were built. Also between jobs Lange takes time off when he wants to. A few years ago he went back to his native Germany for a leisurely visit.

Lange has devised a scheme whereby one or more idle compressors can be started and put on the line within twenty seconds in the event of a sudden demand for more air. A considerably longer period is normally required for a machine to build up enough pressure to close the unloader valves, so Lange introduces air for this purpose from a receiver that is kept charged by a small-size compressor.

Aside from the four compressors mentioned there are four others in the same building. These provided air at 125 psi pressure for operating hoists, wrenches and other pneumatic tools in the tunnel and were also under Lange's supervision. In addition, he watched over two Aldrich 5-cylinder vertical pumps that were driven by Louis Allis motors and supplied water at 4000 to 5000 psi pressure to the 28 jacks that shoved the shield forward. A Watson-Stillman hydropneumatic accumulator ironed out surges in the pressure and assured even functioning of the system. The water was carried into the tunnel in extra-heavy steel pipe 1½ inches in outside diameter.

To insure an uninterrupted supply of electric current for these vital auxiliaries, the Port Authority authorized the Public Service Electric & Gas Company of New Jersey to put in lines from three separate sources of power. Current comes in at 4160 volts and is reduced to 440, 220 and 110 volts for various uses. The power bill for driving the underwater tube is estimated at \$500,000.

(Conclusion)



HUMMING ALONG

Motor-end view of one of the compressors in operation. The units are of the duplex, single-stage type with the motor mounted between the two frames. Shown flanked by the compression cylinders is James A. Brown master mechanic for the contractor.

SCRAPERS: Dragged by two horses, the 1909 scraper (top) could move about 10 cubic yards of dirt a day over a distance of 500 feet. Today's mechanical marvels can gouge out 50 times as much at one bite and race along with the load at 32 miles per hour. Scraper horsepower has doubled in the past ten years.



Roadbuilding Equipment Of Two Eras 1909-1956



EVERY so often the American Roadbuilders' Association holds a national "Road Show" to exhibit the latest equipment for use in constructing and maintaining highways. State and local highway-department officials and engineers from all over the country attend, and there are also many visitors from abroad. The first of these shows was held on the Ohio State Fair Grounds, in Columbus, in 1909 and the next one will be staged at Chicago's International Amphitheatre January 28 to February 2, 1957. Between those two dates lies al-

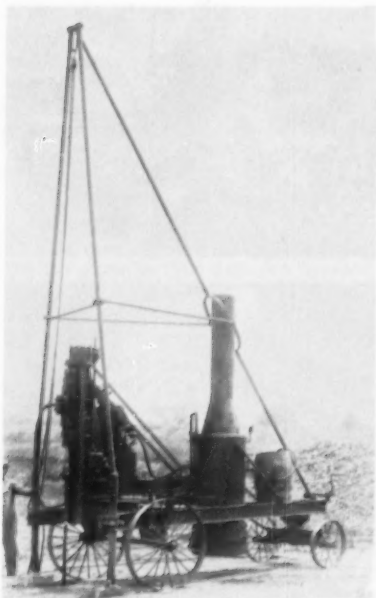
most the entire history of the mechanization of the roadbuilding industry. For that reason the forthcoming exhibition is being billed as the "Pageant of Progress in Construction Machinery."

In 1909 roadbuilding was a simple operation that was carried on with few mechanical aids. Highway engineers were still experimenting with various kinds of bituminous binders, and the asphalt road as we now know it had not been developed. Concrete was a relatively new material, too, and the macadam road was the standard type. To

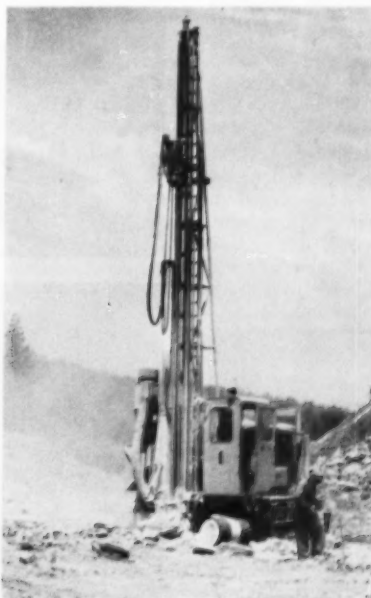
construct one, the roadbed was excavated to a depth of 10-12 inches by means of horse-drawn scrapers. After the subgrade had been prepared to aid drainage, it was compacted with rollers, some pulled by horses and others powered by steam. By filling the hollow roller cylinder with water, its weight could be increased to 10 tons. Rear-end or bottom-dump wagons, also called "stone-spreaders," were used to distribute several courses of broken rock of progressively decreasing size. Each layer, in turn, was compacted by rolling. A surface course, usually of $\frac{3}{4}$ -inch stone and screenings, was laid to wash "binder" down into the voids and to make compaction more effective. Stone crushers of the time could turn out from 400 to 1000 tons a day.

Most of the equipment—carts, rollers, scrapers, graders and stone spreaders—was horse-drawn. Steam power was just being introduced for roadwork. Steam traction engines had been applied for pulling dump wagons and graders and for powering rock crushers and rollers, but they were still a luxury. Steam shovels, long used in railroad construction, were just finding their way into roadbuilding. Aside from the horse-drawn rigs and the few steam engines, highway construction was still largely a pick-and-shovel operation.

However, the Machine Age was on the way, and highway men realized it. One of them declared that "two men with two teams and a grader and a roller can build more road in a day than 50 men can with picks and shovels." At an early ARBA convention a speaker observed that "the introduction of improved machinery has enabled . . . some states to build improved stone and gravel roads quite cheaply," and gave these figures: first-class single-track stone roads 9 feet wide in New York State for \$900 to



DRILLS: The drill wagon of around 1912 (left) consisted of a steam-operated piston drill, a 15-hp boiler and a water barrel on a steel-wheeled chassis. The 1956 self-propelled Drillmaster shown at work on the Northeastern Extension of the Pennsylvania Turnpike puts down a 6- or 6½-inch hole at a speed the old-timers would have deemed impossible.





GRADERS: These were important machines in 1909, and the horse-drawn unit (left) was one of the most popular



models. The modern grader (above) has a 120-hp engine, six speeds forward, three in reverse, and power steering.

\$1000 per mile; excellent gravel roads in New Jersey for \$1000 to \$1300 per mile; macadam roads 9 to 20 feet wide and 4 to 12 inches thick from \$2000 to \$5000 per mile; a first-class Telford road, which required more handwork, \$4000 to \$6000 per mile.

Talk began to be heard about scientific management of men and machines to increase production, and one engineer expressed the opinion in 1909 that, to enable workers to occupy their time to best

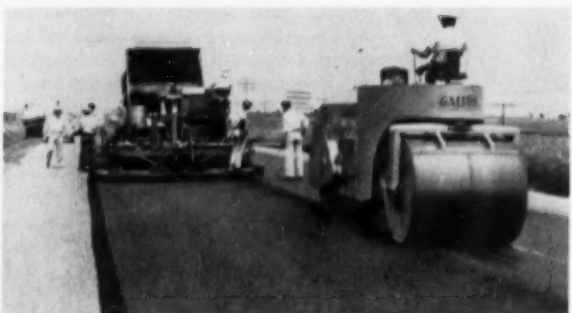
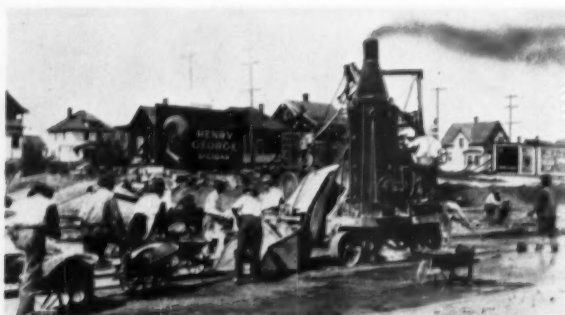
advantage, three teams should be used for power, but thought that a steam tractor or roller could be utilized in place of the teams at a saving in cost. He also recommended that there should be a horse-drawn wagon with a dump box, a field drag or harrow and four or five laborers. "With this force," he said, "the road can be brought to a proper crown and . . . all loose stone, sod and organic matter can be removed." He itemized the cost as follows:

Four teams, per day	\$16.00
Two laborers on machine, \$1.50 per day . . .	3.00
Four laborers following machine	6.00
Total	\$25.00

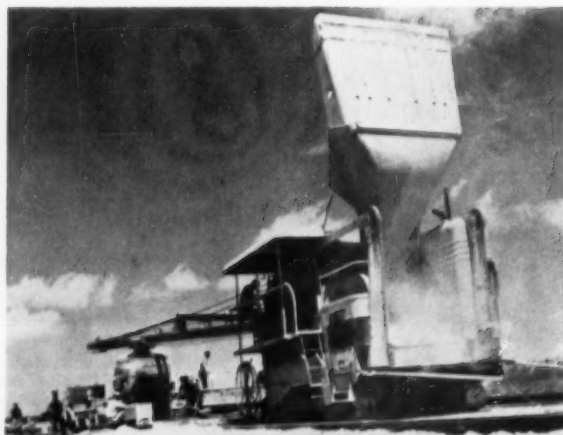
He estimated that a saving of \$7 to \$8 a day had been made in maintaining town streets by using a steam traction engine or roller. "A foreman so equipped," he commented, "should be able to care for and crown an average of from two to three miles of highway each day at a cost of from \$8 to \$12.50 per mile."



CONCRETE MIXERS: In the era of the 5-cent cigar, small-capacity steam-powered mixers provided concrete for wheelbarrow trundlers. Modern mixers are built into huge efficient paving machines that dispense with the need for human brawn.



PAVERS: In 1909 steam rollers and steam shovels were the only power equipment available to roadbuilding contractors. A roller is shown at the top compacting a macadam road for which stone was hauled in a bottom-dump wagon. Both were shown at the first ARBA Road Show. Today's mechanical paver (bottom) moves down the roadway, leaving a wide ribbon of pavement behind. Easily maneuverable diesel-powered rollers have replaced the high-wheeled steam units.



SHOVELS: The 1909 steam shovel (top) puffed and clanged but kept long trains of teams and dump wagons busy. It was the grandfather of today's smooth-operating, diesel-powered units. The machine shown at work on the Ohio Turnpike (bottom) can fill a 30-ton dump truck with four swings.



LOADERS: The elevating grader of the 1920's (top) was pulled by a tractor, but mule teams and wagons still played an important part in road construction. The modern loader (bottom) pushed by a powerful tractor piles 15 cubic yards into a bottom-dump wagon in 25 seconds.

As more new machines came on the market, contractors became enthusiastic and manufacturers got them to write glowing letters that they could use in their advertising. One of them reported, for instance, that a team and a man, at \$3.50 per day, could at the most make six daily trips over a 2-mile route and haul 10 cubic yards of stone one way at a cost of 35 cents a yard. In contrast, a road roller drawing four wagons each holding 4 yards made four trips daily and handled 64 yards at a cost of \$8 or 12½ cents a yard.

Large steel-wheeled steam tractors were the most common of their kind in 1909, but the track or crawler type had been invented in 1905 and was becoming popular. It served to pull rollers, dump wagons and graders. The first tractor-powered scraper with a retractable pan appeared in 1909 and cut the cost of earth moving in half. Before and for some time after its arrival different kinds of horse-drawn scrapers were in use. The drag scraper had a capacity of 3½ to 5½ cubic feet and sold for about \$15. The famous Fresno scraper, pulled by a team of four, was known as the "earth-movingest mule-powered tool ever devised." Heavy-duty 2-wheeled scrapers could handle from 150 to 250 cubic yards a day.

Bulldozers were not standard equipment that early. A contractor had fashioned the first one by attaching homemade blades of various designs to his

steam traction engine. Graders, some with adjustable oblique wheels to hug the grade, were usually horse-drawn, but could be hooked up to a steam tractor.

Even in mountainous country, roads were laid out so as to require a minimum of rock drilling, and the policy was to tolerate steep grades rather than go to the trouble and expense of excavating heavy cuts. Later, as automobiles became more numerous, roads that took less climbing and more drilling were designed. Although the hammer drill was available prior to 1900 and was being used in mining, the easily maneuverable hand-held Jackhammer was still a few years away. The heavy piston drill, customarily mounted on a heavy tripod for highway work, predominated. As a result, drilling was frequently done by hand. A machine known as the drill wagon was soon to appear, but it never became popular for roadbuilding, and the wagon drill, which was later to become the contractor's workhorse, didn't come on the scene until 1926.

Large-diameter blasthole drilling rigs such as the Quartermaster and Drillmaster were not to be introduced for another twenty years. Detachable drill bits were 24 years in the future in 1909 and tungsten carbide-insert bits 37. The only portable compressors supplying air for the drills were makeshift affairs. The 2-stage, air-cooled unit wasn't to reach the market until 1933, and then only in small sizes. The Gyro-Flo, first of the

rotary-type portables, wasn't to make its appearance until 1950.

Such, in essence, was roadbuilding's kit of tools in the year of the first ARBA Road Show. In contrast, today's amazing machines make the task of constructing highways much different. Horsepower and steampower were replaced by gasoline engines in the 1920's and diesels in the 1930's. The introduction of huge pneumatic tires in 1932 started a completely new trend in earth-moving equipment. The modern construction job is served by highly mobile production units, each performing a specialized task.

Huge trucks rumble along with 15 and 20 cubic yards of excavated earth or rock. Self-powered scrapers scoop up and evenly distribute 20 cubic yards of fill at one pass. Heavy tractors with twin diesel engines push-load large scrapers with ease. Efficient rock drills, powerful blasting powder and giant shovels eat their way through the hearts of high hills. At river crossings, cranes with a lifting capacity of 25 tons place steel beams for bridges. On the roadbed itself, subgrade planers, tamers, pavers, spreaders and screeds move smoothly forward on steel rails, leaving a ribbon of finished pavement behind. In the background, large aggregate plants and push-button batching plants turn out quality-controlled paving materials. Examples of this modern equipment on display at the 1957 Road Show will cover 585,000 square feet of the mammoth exhibition hall.

Drilling Starts on \$81-Million Power Project



ACTIVITY STARTS

Jackhammer men, above, working at the edge of the Clark Fork River. Air is supplied by the Ingersoll-Rand 600-cfm Gyro-Flo compressor at the right. At the time the pictures were taken the contractor had seven I-R portables on the job: four 600-cfm units, one 500 and two 315's. Below is a close-up of one of the men using a J-50 Jackhammer in the area to be occupied by the tailrace of the power plant. At the left is one of the rocky islands showing drilling operations. I-R drifters on wagon mountings were being used to put down 2½-inch holes 24 feet deep on 8-foot centers and were averaging from 300 to 400 feet of hole per 8-hour shift.



GROUND was broken recently for an \$81-million power development project on the Clark Fork River in western Montana by Morrison-Knudsen Company, Inc., of Boise, Idaho. Known as the Noxon Rapids Hydroelectric Project, it is being built by the Washington Water Power Company. Initial generating capacity will be 400,000 kw, and the job is scheduled for completion in 1960.

The M-K contract is for \$21 million and covers the construction of a powerhouse and dam. The latter will have an over-all length of 5930 feet and a maximum height above bedrock of 190 feet. It will be made up of a central concrete

section flanked by two earth-fill wings.

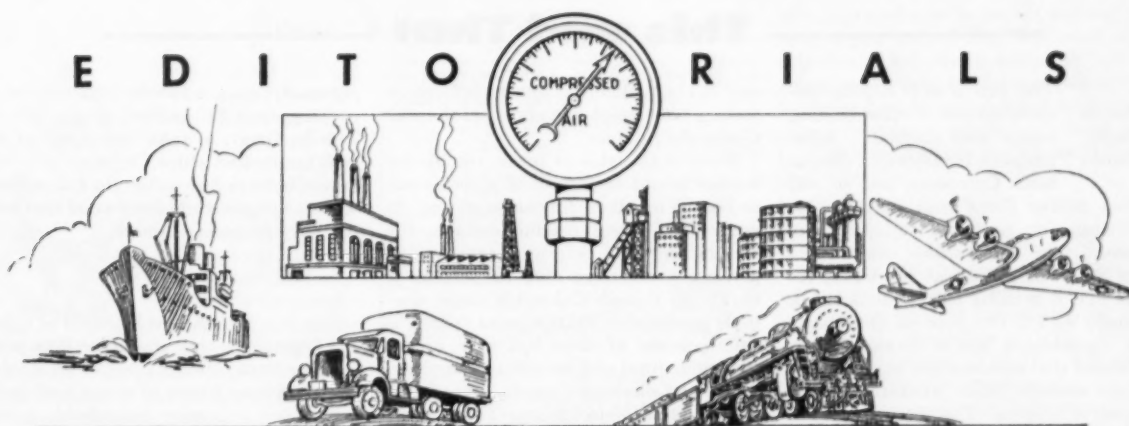
Excavation in the riverbed and on the abutments is estimated at 1,885,000 cubic yards, of which 240,000 will be rock and the remainder clay and gravel. The rock is chiefly argillite (clay-slate) and siliceous clay. A considerable part of it is in two islands in the river.

Approximately 3,303,000 cubic yards of clay, sand and gravel will be removed, transported and placed in the earth-fill sections of the dam, and 540,000 cubic yards of concrete will be used on the job.

Ebasco Services, Inc., is in charge of the engineering of the project and will supervise construction.



E D I T O R I A L S



MANNA FOR THE RAILROADS

FACED with continually declining passenger traffic, the nation's railroads are in somewhat of a financial dilemma. Every rise in rates diverts some of their patronage to other forms of transportation. Transient travelers pay whatever they have to, albeit reluctantly, but commuters in urban centers strenuously resist every effort to increase fares. Reducing schedules likewise fails to solve the problem and, besides, peeves the public. The situation has impelled one major rail system, the New York Central, to offer several hundred of its little-used passenger depots for sale. This, at best, will help only temporarily.

However, the dark cloud may have a silver lining. Railroads run into or close to the business centers of cities and hold valuable property rights. As long as trains were pulled by steam locomotives no one ever thought of erecting buildings over tracks, but electrification and depression of lines approaching terminals made the idea practicable. Office structures have long straddled the rails leading into some of Chicago's stations, and New York's Park Avenue provides another notable example. Plans are on the boards for huge new combination terminal and office-commercial buildings for both the New York Central and Pennsylvania Railroad in New York City.

Now comes a new slant of the same idea from Philadelphia. Just north of its main Thirtieth Street Station the Pennsylvania has a yard that covers nearly eighteen acres, and it has suggested that the city make it the site of a stadium on stilts. In exchange for the air rights there the railroad is willing to accept trackside property of equivalent value elsewhere. The possibilities of the scheme are now being investigated by a committee that has the job of determining whether the city needs a new stadium and, if so, where it should be constructed.

The desirable feature of the railroad site is its accessibility. A stadium at that

point would be within ten minutes travel time from downtown hotels, only 25 minutes from the International Airport and convenient for motorists. There would be adjacent parking spaces for 4000 cars and room for 15,000 within eight blocks. The cost of an adequate stadium there is estimated at \$20 million.

BEWARE OF BLASTING CAPS

THE lay mind associates dynamite with danger. Those who are unaccustomed to handling it have hearty respect for its hazardous nature. Even children seem to be aware of its potential power to maim or kill. At the same time, adults and juveniles alike underestimate the risk of handling blasting caps. Actually, dynamite is relatively safe by itself and normally requires a cap to set it off. The relationship is somewhat like that between tinder and matches. The match is the villain of the pair. The point we are trying to make is that blasting caps are more to be feared than the chemical mixture they explode.

For 30 years the Institute of Makers of Explosives has waged a campaign to safeguard children from the perils of playing with blasting caps. It urges explosives users to keep their caps locked up and cautions children not to handle them. The Institute can put over the first point by itself, but to reach children it must have the help of parents, teachers, police authorities, the press, television and radio. Statistics prove that blasting-cap mishaps are now comparatively rare: the accident rate is one-sixth that of 1926. Nevertheless, there are still accidents, and if there were but one a year it would be too many.

One thing against blasting caps is their deceptively innocent appearance. Their size belies their destructive power, and their bright and shiny look makes them attractive to youngsters. They will be picked up and experimented with as long as they are left lying around.

FEAST OR FAMINE

INDUSTRY is still wondering how it can recruit more engineers, and many ideas are being expressed. One recent suggestion (by a research technician) is to find a way of glamorizing college technical courses. If engineers could be placed on a pedestal of popularity as high as that reserved for football heroes the problem would, admittedly, be solved because high-school graduates would hasten to enroll in engineering schools. It doesn't seem likely, though, that anyone will discover how to transfer the aura of the stadium to the classroom. And perhaps that is a good thing. Somehow, we imagine Jack would be a dull boy if his affections were to be alienated in this manner. Sports build sound bodies, which are of paramount importance, and hence have a vital place in our educational program. We would, indeed, become a weak and sorry nation in a few generations if our youth were fed intellectual fare alone.

Another commentator thinks that better compensation for engineers would lure more young folks into the halls of engineering. He claims that the pay of technical men during the 1950-55 period advanced only four percentage points more than that of production workers—32 percent vs 28 percent, and that it rose only 29 percent in the case of scientists of the Ph. D. level. These figures no doubt represent a cross section, including engineers of all ages. Anyone familiar with industry is aware that embryo engineers fresh from college are now starting out at rather handsome figures as measured by 1940 or even 1950 standards.

It is being demonstrated, we believe, that the law of supply and demand works here as elsewhere. The scarcer technical men become, the higher will be the bids for their services. This will eventually have the effect of boosting enrollments in engineering schools, and one day the pendulum will begin to swing the other way. It has been and probably always will be that way, whether the commodity is brains, brawn, beans or bonbons.

This and That

Pen Is Still Potent

The pen is still mighty despite the rise of other writing media and methods. Minneapolis-Honeywell Regulator Company, one of 130 United States firms that produce instruments for recording temperature, pressure, flow and various other operating data for industrial processes, reports that it is using 1850 gallons of ink annually to fill the pens of the chart-type recorders it has in service. It is estimated that this amount would keep a quarter-million office workers writing for twelve months. The year's supply of paper for the charts approaches two million pounds.

* * *

Lumber Men Are in The Chips

Leftovers of the logging industry that used to be burned or discarded are now going into paper in the Northwest. Sawmills are separating the chips and selling them for good prices. In lots of cases, this extra revenue means the difference between profit and loss for the operation. Sawdust and shavings

also are being utilized to some extent in making hardboard, but chips are the real Cinderella product.

When a Douglas fir log is cut up for lumber, about 44 percent of it comes out as boards or other dimension pieces, 20 percent is coarse residue suitable for making chips, 13 percent is sawdust, 10 percent is shavings and 13 percent is bark. In British Columbia alone sawmills produced 1,200,000 units (a unit is 2400 pounds) of chips last year, or the enormous total of 2.88 billion pounds.

Crown Zellerbach Canada Ltd recently built a \$29-million addition to its paper mill at Elks Falls, B.C., which uses chips exclusively as raw material. The plant is turning out 400 tons of kraft paper daily and plans to increase the output to 500 tons. That will require 29,000 units of chips (69,600,000 pounds) each month. The material comes from 25 individual sawmills in the same general area.

Mills that formerly sold chips along with other wood waste as fuel at \$1.25 a unit are now getting up to \$11.50 for the chips. Receipts constitute as much as 50 percent of the total net income for some plants, with the average between 10 and 15 percent. One manufacturer of

plywood, Georgia-Pacific Corporation, is putting up a \$17-million paper mill at Toledo, Oreg., to take advantage of its own by-product chips. It expects to sell annually from \$10 million to \$12 million worth of paper made from wood that was formerly considered waste.

* * *

Fighting Fire With Detergents

A novel method of fighting coal-mine fires with foam created by a mixture of water and ordinary household detergent is described in the July issue of *Mining Congress Journal*. Although it had not been tested in a real mine fire when the article was written, experiments in England have given every indication that it would be successful.

Briefly, the technique consists in spraying a dilute water-detergent solution through a cotton net fastened across a mine entry at a 45° forward slope from bottom to top. The holes in the net are about 1/8 inch in diameter and 1/8 inch apart. When the solution passes through the screen it forms a huge mass or plug of foam that fills the entire cross section of the entry and travels forward under the impulse of the ventilating air. When this blanket of bubbles reaches a fire it smothers the flames. (Flaming combustion usually ceases when the oxygen content falls below 15 percent. If the volume of the water is 1 in 1600 parts of foam, the oxygen content will be reduced to 10.5 percent.) Water is used at a rate of approximately 60 gpm and at a pressure of around 70 psi. In the demonstrations, the foam traveled 90 yards in a minute or two and a total of 200 yards before disintegrating. The aim is to develop a "tougher" foam that will deal with fire at least 1000 feet away.

* * *

Athletes Turn Movers

Rutgers University, at New Brunswick, N.J., had planned to transfer books, pamphlets and other contents of its 52-year-old library to a new \$4,000,000 structure by power and gravity conveyors. However, someone forgot to design the equipment so that it would cope with a circular staircase in the old building, and the idea went for naught. To fill the gap, Rutgers athletes who were seeking to toughen themselves for the competitions of the school year were pressed into service. Most of them were football men, but some were important in other fields. For example, Ken Eiker, a 6-foot-5 basketball player proved adept at handing down books from top shelves, and Don Kovalchick, a 137-pound wrestler was

Inflatable Hut from Britain

AN INFLATABLE, rubberized-fabric hut that can be set up by one man in three minutes is being manufactured in Great Britain. It is intended for use by military units or hospitals (30 men can sleep in one), on construction jobs, by circuses and fairs or to house temporary laborers or pickers on farms. As shown, the covering is attached to a hollow tubular framework that can be expanded with a portable electric blower. The floor, also of rubberized cloth, is detachable. Six windows of clear plastic can be opened read-

ily, and there is a louver above each one to insure adequate ventilation. Doors at both ends are closed by zippers. Outlets are provided for electric-light and telephone connections.

There are no poles to cope with or carry, and the whole shelter can be folded for transport into a package 4 1/2 feet long and 18x18 inches square. It weighs 160 pounds. The hut, called the Numax, is made by Elliot Equipment Limited of Llwynypia, Rhondda, South Wales, which has produced inflatable life rafts and full-size dummy aircraft.



Breezy's Boner



As pointed out in last month's installment of our articles on the Lincoln Tunnel third tube, The Port of New York Authority made a carefully organized drive for safety, even to spending \$200,000 for a well-

equipped and staffed medical center at the Weehawken, N.J., shaft. Just before the shield set out on its crossing of the Hudson River under air pressure, each employe received a booklet of cartoons depicting in humorous vein the misadventures of an irrepressible, cheeky fictitious worker called Breezy.

Typical of the messages the book conveyed is this one on proper rock drilling. Three Port Authority engineers were in the tunnel at all times checking and inspecting to make sure that every step was carried out as safely as possible. The campaign had a gratifying result: for the



first time on a job of this character and size the shield crossed the river without a single fatality from an accident or "the bends."

handy in getting into nooks and crannies where others wouldn't fit. Approximately 3000 wooden boxes were used in moving some 500,000 books.

★ ★ ★

The Mechanics and Farmers Savings Bank in Bridgeport, Conn., is using television and a pneumatic-tube system to serve drive-in customers without meeting them face to face. A person making a deposit stops his car in front of a TV screen at a curbside station located around the corner from the bank's main entrance. When he pushes a button, the image of a teller appears on the screen and he hears his greeting. The customer states his business, whereupon a small door opens and discloses a pneumatic-tube cylinder and terminal. He places his money or checks and passbook in the

cylinder and inserts it in the tube, which whisks it 100 feet to the teller's desk on the banking floor. The latter makes the entry and returns the passbook.

Withdrawals can be handled in the same way. On a dark day the teller flicks a switch to train a spotlight on the customer's face, and his own features also are well-lighted for mutual identification. The approach to the station has room for five cars. Bullet-proof glass protects the television unit from vandalism.

The "remote-control" banking system was devised by the Mosler Safe Company to supplement its previous scheme of using the periscope idea of reflecting the images of the parties to a transaction by mirrors. This arrangement made it necessary to locate the teller just below the sidewalk, whereas the new one permits him to be anywhere in the bank.

★ ★ ★

A railroad between Saarbrücken and Neukirchen, Germany, has experienced trouble for ten years because of subsidence caused by the extraction of coal from underneath it. At the high point in the line there is a tunnel 3/10 mile long that was constructed in 1850. To safeguard it, digging under it was prohibited, but that did not apply to the sections traversed by the approaches, which have undergone progressive sinking that has affected both their alignments and grades. Meanwhile 8,000,000 tons of coal remains in the tunnel zone. To correct the

situation and also to permit mining the coal, a new tunnel that will bend with subsidence has been designed. It is based on the principle of metal-clad hose to obtain flexibility and can, it is claimed, even be flattened into an oval cross section without endangering its stability.

★ ★ ★

General Electric Company has developed a latchless door for refrigerators that is held closed only by the attraction of an Alnico permanent magnet. The door will open if subjected to the pressure that would normally and instinctively be exerted by a trapped child. The device meets the provisions of a law signed by President Eisenhower on August 2 which requires manufacturers to equip refrigerators with doors that can be opened from the inside. Legislation was prompted by the fact that 115 children have lost their lives in the past ten years by imprisoning themselves in abandoned refrigerators.

★ ★ ★

Whistling Away Nostalgia

Fliers stationed at remote Meeks Field in Iceland complained of homesickness, and one of them said he would like to hear the familiar sound of a train whistle. Through an officer of the Royal Canadian Air Force a vice-president of the Canadian National Railways heard about it and sent the airmen what is described as a "Billy's Whistle." He informed them, however, that they might have to find a geyser in order to blow it. "Failing that," he wrote, "any of your air compressors generating from 50 to 100 pounds pressure should do the job." To add realism, an engineer's cap was sent along to be worn by the operator of the whistle.

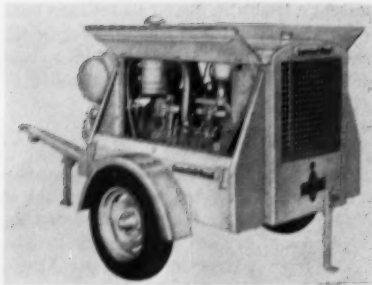


"It was a challenge, all right, but our chief engineer is a college graduate."



"I hear you have a new filing system, Miss Smith—may I see it?"

Industrial Notes

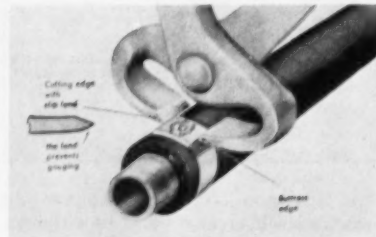


One more size has been added to the line of Gyro-Flo compressors according to a recent announcement by Ingersoll-Rand Company. This makes the sixth and smallest of these oil-cooled, rotary portables, giving them a capacity range from 85 through 900 cfm. Fully equipped with tool boxes, fenders and 2-wheel spring-mounted running gear, and filled with fuel, oil and water ready for service, the new unit weighs only 1840 pounds, making it ideal for installation in or on even the smallest truck. So mounted its net weight is 1375 pounds and it stands 42 inches high. The Gyro-Flo 85 is a single-stage machine and is driven by a 4-cylinder, 4-cycle Continental Motors F-140 gasoline engine of "L" head design with exclusive individual porting.

Push-button controlled, a heavy-duty 6-volt battery system insures ease of starting under all conditions. It includes most of the features that characterize the type, which is said to have found wide acceptance since its introduction in 1950.

Circle 1E on reply card

To facilitate the removal of its Punch-Lok clamps from hose lines, Punch-Lok Company has designed a special tool of rugged construction that is said to cut off the Lok with little effort. Known as



Model D-550, it features a single cutting jaw with slip land to prevent gouging hose, while the other jaw serves as a buttress edge. The tool is 14 inches long, has a heavy-riveted, single-pin joint and is made of drop-forged high-carbon steel.

Circle 2E on reply card

Adaptable Teflon is the base of an antistatic coating put on the market by General Plastics Corporation. Named Gencote 108, it can be applied in multiples of 1/2 mil to 10 mils on any metal or other surface that can withstand 700°F, the temperature required for the baking process. (A 4-mil film is said to have an electrical resistance of about 1 ohm.) It is recommended as a coating for the interior surfaces of chemical and drug cone blenders to prevent powders from sticking, for conveyors to speed the flow of pulverized products and for mechanical handling equipment to prevent the detonation of explosive materials through static electricity.

Circle 3E on reply card

The availability of plastic hose designed for medium flow rates of compressed air at working pressures up to 125 psi has been announced by Hofmann Engineering Company. The new hose is made of a special bright-red plastic designated as H-52 and has been field tested in "on-the-job" applications for more than five years. It is stocked in 100-foot coils, with or without fittings, and in complete assemblies of any desired length. At present there are four sizes: 3/16, 9/32, 3/8 and 1/2 inch, inside diameter. (Outside diameters are approximately twice the corresponding inside measure.) Other sizes and colors are made to order. The manufacturer

NON-FLUID OIL

TRADE MARK REGISTERED

THE VERSATILE PNEUMATIC TOOL RUSTPROOFING LUBRICANT

There is an "NR" grade of NON-FLUID OIL available for all types of equipment, under every weather and working condition.

Here are examples of lubrication recommendations for various applications . . .

NON-FLUID OIL A- #88-NR—most widely used grade, suitable for chipping hammers, riveters, drills and other equipment, in temperatures down to -30°F.

NON-FLUID OIL A- #89-NR—for use in place of A- #88-NR, where hot, humid air is present.

NON-FLUID OILS A- #90-NR, A- #59-NR, A-Sixty-NR & A- #79-NR—for warm weather operation of heavy-duty equipment, such as drills, drifters, pile drivers, hoists, etc.

Send for free sample and Bulletin 550 with complete information.

NEW YORK & NEW JERSEY LUBRICANT COMPANY

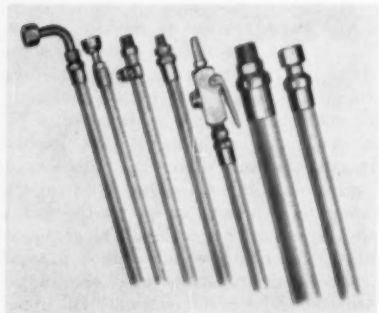
292 MADISON AVE., NEW YORK 17, N. Y.
WORKS: NEWARK, N. J.



WAREHOUSES
Birmingham, Ala. Greensboro, N. C.
Atlanta, Ga. Greenville, S. C. Detroit, Mich.
Columbus, Ga. Chicago, Ill. Providence, R. I.
Charlotte, N. C. Springfield, Mass. St. Louis, Mo.

NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

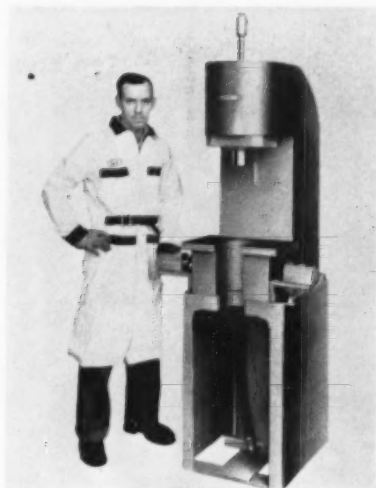
Circle 16A on reply card



claims that H-52 is resistant to oil, gasoline, water and weak acids and alkalis and that it is durable and abrasion resistant in service. The lightweight hose (a 100-foot coil of 1/2-inch I. D. weighs only 33 1/4 pounds) has the characteristic smoothness of plastic that results in effective transmission.

Circle 4E on reply card

Production has been started by Air-Hydraulics, Inc., on a big air-hydraulic press for forming, flanging, riveting, broaching, staking, crimping and other operations on varying materials from metal to leather. The C-500 has no intricate mechanisms or parts to wear out,

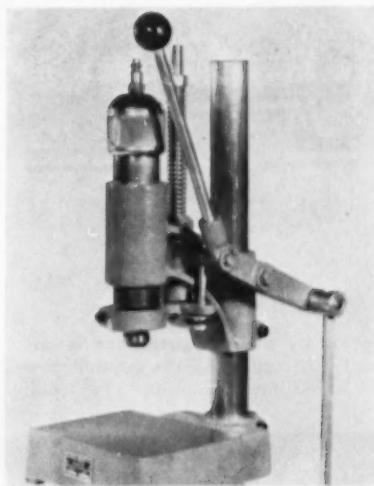


A new air gun developed by Union Engineering Corporation has a unique safety feature—an "umbrella" of high-pressure air that always shields the air blast to prevent chip flyback. Both issue from the nozzle simultaneously. The conical screen is produced by fluted passageways through which some of the air is diverted when the operator presses on the trigger of the pistol-type gun. The unit is called the Guardair.

Circle 6E on reply card

By means of a new tool called the Wizard Wire Plier it is possible to bend the end of a wire into a loop, to form hooks for use on captive screws, to cut wire and to strip insulation. It is designed to handle Nos. 10, 12 and 14 copper wire and is made by United States Research Corporation.

Circle 7E on reply card



quency of 6500 cycles per minute. The machine is said to be effective for riveting, light swaging, upsetting, planishing sheet metal, crimping seams, driving pins and assembling parts.

Circle 8E on reply card

and for its size (15 inches wide, about 27 inches deep, 40 inches high on a 34-inch stand) is said to exert exceptionally great force. It has a rated capacity of 15 tons, increasing to 21 tons with a line pressure of 100 psi. The standard model has an 8¼-inch throat and delivers a 6-inch stroke at 10 cycles per minute. Other sizes are custom made. The press is available with three types of control: dual hand, foot and fully automatic. Safety features are provided for the protection of the operator.

Circle 5E on reply card

With its new 150-RH pneumatic hammer, Heidrich-Nourse Company has departed in several respects from its earlier VS Series, a single-acting variable-stroke machine using constant air pressure. The latest model has the same base and frame but is a high-speed repeating unit with a 1-inch diameter hammer operating at constant stroke with variable pressure. Contact of the tool with the work opens the hammer valve, and so long as pressure is maintained by the foot pedal the hammer shuttles up and down at a fre-

Rotary actuators that are said to differ considerably in design and construction from other means of achieving rotary fluid power have been announced by Carter Controls, Inc. A self-contained unit that functions on water, oil, gas or air pressure, it delivers positive rotary

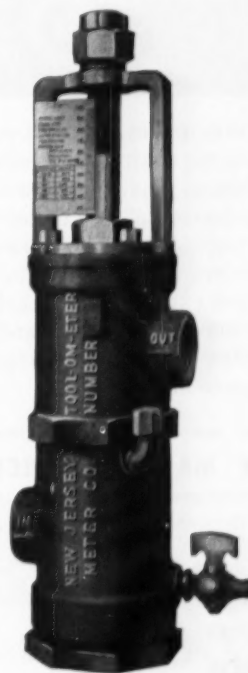
THE TOOL-OM-ETER

Compressed Air Meter shows direct on a scale, in cubic feet of free air per minute, the flow of air in a pipe or hose. These meters will show the air consumption of any pneumatic tool, rock drill, air motor, sand blast, air-lift, or other application of compressed air.

They are also used for maintaining air equipment in most effective working condition. You can get the facts about your use of compressed air, and these facts will enable you to bring your costs and production under profitable control. Write for new Bulletin A-8.

WE SPECIALIZE in compressed air devices, including the "DriAir" Separator for automatically removing the water from compressed air lines. Ask for Bulletin DA.

New Jersey Meter Co.
Plainfield, N. J.



Circle 17A on reply card



in its 360-degree rotation cycle and held there indefinitely. There is no by-pass leakage or pressure loss and, because of the helix, the work load cannot back off under reverse tension, shock or vibration even in case of complete power loss. Through the medium of antifriction thrust bearings the actuator can be operated on pressures from 5 to 500 psi. It is being built in a variety of standard sizes and rotation cycles.

Circle 9E on reply card

motion by use of a piston and internal helix. According to the manufacturer, the actuator can be stopped at any point

Ansul Chemical Company has introduced a fire extinguisher that contains 2½ gallons of water under pressure. It is operated by squeezing a grip carrying



handle and can be turned off at will, thus reducing damage to a minimum. The stream of water is discharged at full force from start to finish, it is claimed, and has a reach of 35-40 feet. The container can be quickly refilled and recharged with air at 100 psi, and a tricolored gauge tells at a glance whether the pressure is adequate to operate the unit effectively. With the addition of antifreeze it is said to function properly in temperatures as low as -40°F. Underwriters' Laboratories has classified it as 2-A, the highest rating given extinguishers of this capacity for Class A fires (wood, paper, rags and similar materials).

Circle 10E on reply card

MAXIM SILENCERS

FOR ALL
INDUSTRIAL
REQUIREMENTS

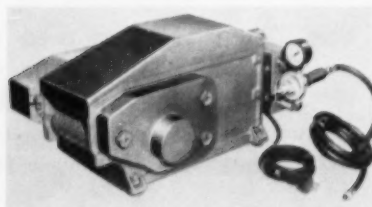
35 STANDARD MODELS
in sizes to fit 1" to 72"
exhaust connections



Maxim makes the most complete line of silencing equipment available to industry. That means many "special requirements" can be solved with one of Maxim's "standard" units. If your problem is truly "special", Maxim's longer experience will help you get the answer more quickly and efficiently. Either way it always pays to consult Maxim first.

SILENCERS FOR:

- INTERNAL COMBUSTION AND STEAM ENGINE EXHAUST AND INTAKE
- AIR COMPRESSOR INTAKES AND DISCHARGES
- VACUUM PUMP DISCHARGES
- BLOWER INTAKES AND DISCHARGES
- STEAM, AIR OR GAS DISCHARGES
- JET AIRPLANE ENGINE EXHAUST AND INTAKE
- WASTE HEAT RECOVERY



AIR OPERATED

This tape dispenser made by Air Fixtures Incorporated is the largest of four models that function without push buttons, handles or pedals. Simply withdrawing the tape actuates a microswitch and that sets the next delivery cycle in motion. They dispense tape in lengths up to 21 inches and 4 inches wide made of such materials as heavy paper, cloth, plastic film, cellulose, and glass and acetate fibers.

Circle 11E on reply card

THE MAXIM SILENCER COMPANY

61 Homestead Ave., Hartford, Conn.

Gentlemen: Please send bulletins on silencers for:

NAME

COMPANY

ADDRESS



pressure of 0.5 microns. Its use is said to assure bright surfaces and reproducible results, to prevent adverse changes in surface chemistry and to remove surface contaminants. Designed primarily to meet the demand for vacuum-annealing titanium, it is equally useful for sintering, brazing, hardening and degassing. The vertical arrangement of the heating element and vacuum bell make the furnace suitable for operation where product handling is mechanized.

Circle 12E on reply card

For workers exposed to high temperatures, Union Industrial Equipment Corporation has designed ventilated clothing that gives them bodily comfort and



protection. The suit consists of a pair of coveralls made of flame-resistant cotton, dynel or other fabrics, of a removable aluminum manifold with a $\frac{3}{8}$ -inch baffled opening at the back and of flat, flexible tubes (indicated in black) through which compressed air is distributed. Air at 90-110 psig is introduced by a $\frac{1}{2}$ -inch hose at the rate of 200-250 cfm but,

Are You Looking for FASTER, BETTER, CHEAPER Methods?



When it comes to pipe lines for air, water, ventilating, dredging, hydraulicking or materials handling, Naylor Spiralweld pipe offers you a **proved way** to get these jobs done faster, more dependably and at lower cost.

The light weight of this distinctive pipe makes for faster, easier handling. Naylor's exclusive structure provides extra strength and safety for dependable performance no matter how rough the going. And, the one-piece Naylor Wedge-Lock coupling gives you the fastest method of connections to simplify installation and cut costs.

If you are looking for ways to speed up pipe line operations in construction service, get the facts on Naylor pipe and Wedge-Lock couplings today.

Ask for Bulletin No. 507.

NAYLOR  **PIPE**

Naylor Pipe Company • 1245 East 92nd Street, Chicago 19, Illinois
Eastern U.S. and Foreign Sales Office: 350 Madison Avenue, New York 17, New York

Circle 19A on reply card



with an ADAMS AFTERCOOLER in your compressed-air system

Is compressed air-line condensate causing you to lose valuable production time? Do numerous blow-downs add to the cost of operating your compressed air system? Do you have a heavy air-tool maintenance load?

These headaches are common when a compressed air system needs an Adams Aftercooler and Cyclone Separator . . . where your compressor discharges directly into the receiver. With Adams units, your compressor discharges hot, vapor-laden air into the Aftercooler. Here the air temperature is reduced to within 10° F of the cooling water. As a result, excess water and oil vapors are condensed.

The Cyclone Separator removes virtually all condensate from the air as it flows from the Aftercooler. That's because the Adams design achieves a high separating factor—even over wide ranges of flow.

Compressed Air, conditioned by this Adams team—Pipe Line Aftercooler and Cyclone Separator—normally enters the distribution system below the ambient temperature. Thus, there can be no further condensation to cause you trouble.

For Twenty Years the Adams team has given thousands of customers dependable, trouble-free compressed air. So, if your plant has problems due to condensate in your air lines, there's a simple answer. Write for our Bulletin 711 and see for yourself.

R. P. ADAMS CO., INC.

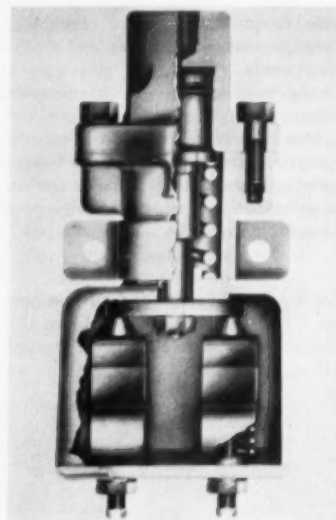
209 East Park Drive, Buffalo 17, N. Y.

Circle 20A on reply card

where conditions permit, the volume can be decreased by attaching a larger-diameter hose. If worn with an available safety helmet and hood, a regulated amount of air is admitted at the neckline of the suit, which is also provided with a D-ring between the shoulders for attaching a life line strong enough to pull more than 400 pounds. At a temperature up to 175°F, the new clothing is said to allow a work schedule of 105 minutes on and 15 minutes off, as compared with 20 minutes on and 20 off at 150°, the previous minimum.

Circle 13E on reply card

A new piston pressure switch capable of sensing two different pressures in one system and of actuating independent electrical circuits at two desired points has been announced by Barksdale Valves. The device, it is claimed, accurately "feels" and maintains pressures through-



out an adjustable range of 15 to 3000 psi for proof pressures from 3000 to 7000 psi, depending upon the settings, which are made by two external screws that can be locked to avoid accidental disturbance. The switch is provided with an adaptable mounting bracket that can be rotated to any position in a full circle and moved up and down on the neck of the switch. There are two models, one of which has two calibrated dials to permit setting without gauges before or after installation on a pressure line.

Circle 14E on reply card

Loctite, a new liquid compounded of plastics, is intended to set inside threaded fittings and to prevent loosening caused by vibration. A product of American Sealants Company, it is said to resist chemical attack by common solvents, oil and water and to set in about 24 hours to effect a seal that will withstand temperatures up to 300°F.

Circle 15E on reply card

BRIEFS

Southern California Edison Company, which operates 33 generating plants and has invested a billion dollars in properties, is 60 years old this year. It was started with \$11,000.

Completion of the Seyham Dam and hydroelectric station in Turkey has brought about a reduction in the cost of household current from 13.9 cents to 5.3 cents per kilowatt-hour. This is still several times the current rate paid in the United States.

A British firm has found a simple way to obtain high-grade calcium carbonate for use in pharmaceuticals, plastics, fertilizers and paints. It grinds eggshells, of which a certain amount goes back to the hen as an ingredient in poultry food.

The Army Signal Corps has developed a neoprene balloon carrying miniature radio equipment that sends weather data to a ground receiving station. Inflated with a lighter-than-air gas, the new bags rise at a rate of 1800 feet per minute and reach a maximum height of 15 miles.

The one-hundredth anniversary of the birth of Nikola Tesla will be celebrated by the American Institute of Electrical Engineers at its annual meeting in Chicago, Ill., October 1-5. Tesla is best known for his invention of the alternating-current motor.

The "Mae West" life jacket that is widely used by pilots of military aircraft flying over water can be equipped with a new device that turns on the inflation gas as soon as the wearer is immersed. Many pilots have been known to drown after falling into the water.



"This is Joe Green, dear. He's an automation engineer."

ONE OF THE GARLOCK 2,000

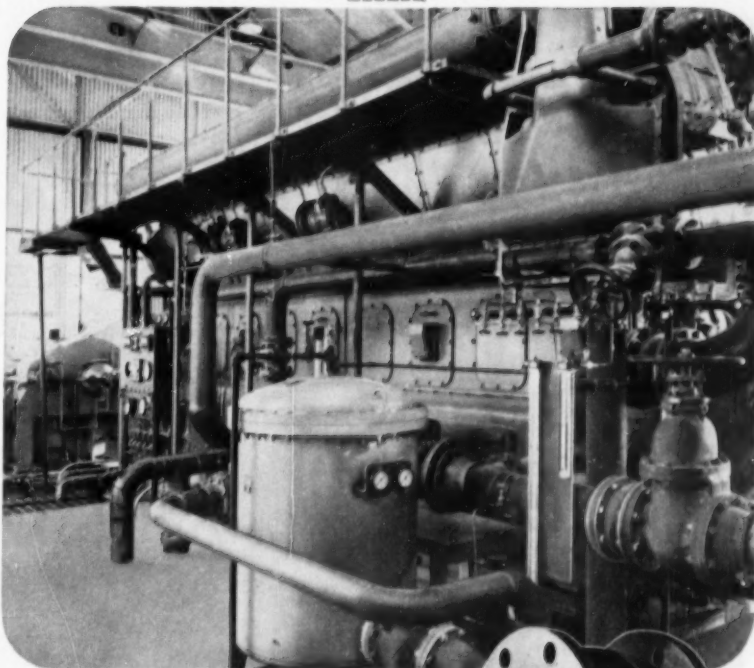
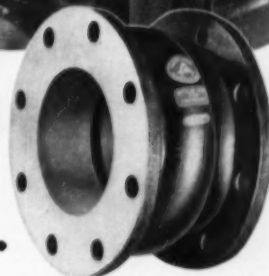


Photo Courtesy Cooper Bessemer Corp.

First Unattended Compressor Station Installs...



DEPENDABLE GARLOCK EXPANSION JOINTS

Gulf Interstate Gas Company's Stanton, Kentucky station automatically pumps 400,000,000 cu. ft. of gas per day into northern markets. It's the first fully-automatic engine driven centrifugal compressor station...it's remote-controlled from Clementsville, Ky., 80 miles away. Obviously, the equipment supplied for such a project had to be the most reliable. Garlock neoprene-lined Expansion Joints were used on both oil and water lines to dampen vibration.

Rubber Expansion Joints are an important part of "the Garlock 2,000"...two thousand different styles of dependable gaskets, packings, and seals. It's the only complete line. It's one reason you get *unbiased* recommendations from your Garlock representative. Call him or write for Expansion Joint Bulletin AD-137.

THE GARLOCK PACKING COMPANY, Palmyra, New York

For Prompt Service, contact one of our 30 sales offices and warehouses throughout the U.S. and Canada.

GARLOCK

Packings, Gaskets, Oil Seals, Mechanical Seals,
Rubber Expansion Joints

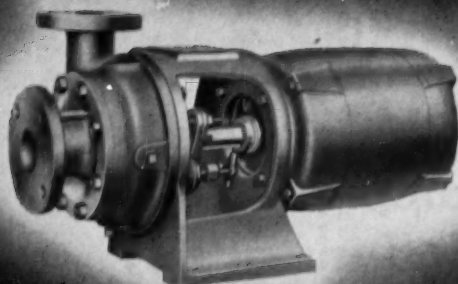
Circle 21A on reply card



IT PUTS THE
SQUEEZE
ON PUMPING

COSTS

MOTORPUMP



When you compare the Motorpump with any other pump . . . feature by feature . . . size by size . . . you'll quickly see why it is out in front for all liquid handling applications. Installing it gives you *proof*. For one thing, you'll generally find you can use a *smaller* Motorpump to do the work assigned to pumps of larger horsepower. So costs are lower.

- Moreover, Motorpumps are so compact and efficiently designed that you save space and reduce power consumption. Installation is also simplified because they can be mounted in *any* position—on floor, wall or equipment—with no foundation needed!

Get to know the I-R Motorpump line—ranging in size from 1/4 to 75 hp, 5 to 2800 gpm with heads to 650 feet.

Send for latest bulletin giving full data needed to choose a Motorpump.



Ingersoll-Rand

9-367 11 Broadway, New York 4, N. Y.



unconscious because the valve of the garment had to be operated manually.

For the first time in the 72 years in which records have been kept, the mining industry of Colorado went through the first six months of 1956 without a fatal accident.

The use of compressed air at national trade shows increases steadily. At the recent American Society of Tool Engineers Exposition in Chicago, Ill., air was supplied to the booths of 107 exhibitors.

The town of Châtellerault, France, for years a government arsenal, has recently been abandoned as such, leaving idle a surplus of factories and trained workers. An organization has been formed to provide for their future by obtaining rights to manufacture and distribute American products that have sales possibilities.

Those who think American streets are congested may find food for thought in the fact that two daily newspaper publishers in Paris have shifted some of their deliveries from trucks to Seine River motorboats. Ten are in service, and save two hours in reaching points on the eastern and western fringes of the city.

Afraid of fire? You can now get a tiny fire alarm that emits a loud squawk when heat in the area protected reaches 140°F. The unit weighs only 6 ounces and can be plugged into any a-c outlet. It draws no current except when signaling, is reusable and can be tested by holding a lighted match nearby.

The usually methodical Germans lost blueprints of a World War II submarine that was scuttled in the Kattegat at the conclusion of hostilities. As a result, they recently raised the vessel at great expense so that it might be used as a prototype for new underwater boats to be built for the West German Navy.



"Under the company's plan I can retire in seven years and take things easy."

Books and Industrial Literature

Engineering Formulas and Tables is a pocket-size book containing basic formulas, design data and tables for the three branches of engineering. Of 350 pages, it includes sections on mathematics, measures, materials, gauges, screws, mechanics, electricity and magnetism, hydraulics, reinforced concrete, pipes and fittings and steam and mathematical tables. The result of 40 years of compilation, condensation and revision, the data book should be a useful addition to the libraries of civil, mechanical and electrical engineers. Lefax Publishers, Ninth and Sansom Streets, Philadelphia 7, Pa. Price, \$2.75.

Complete information on self-locking nuts made by Con-Torq, Inc., for varying bolt and screw sizes is contained in a new loose-leaf catalogue. The fasteners are placed or removed for reuse with standard tools and guaranteed to be proof against vibration and the weather.

Circle 16E on reply card

Pan-A-trol is the trade name of a packaged or centralized control panel made by General Electric Company to customers' specifications in keeping with automation and modern machine design. Various forms are illustrated and described in detail in Bulletin GEA-6334.

Circle 17E on reply card

For repair crews, maintenance men, farmers, shops, garages, etc., Punch-Lok Company has released a condensed catalogue, F-279-R2, on its hose clamps, locking tools, fittings, accessories and its Clamp-Master Kit containing an assortment of 45 standard clamps and a P-38 Loking tool.

Circle 18E on reply card

Detailed information on hand- and man-hole fittings for tanks and pressure vessels used to store hazardous liquids above or under ground is contained in a bulletin obtainable from The Colorado Fuel & Iron Corporation. The fittings are available in a variety of shapes, sizes and specifications.

Circle 19E on reply card

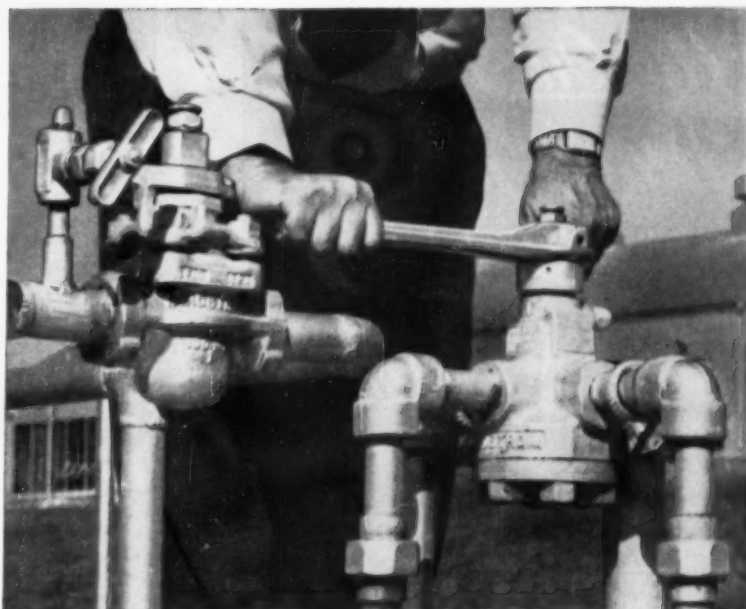
Interested readers can obtain a 75-page illustrated pocket manual from Allis-Chalmers Manufacturing Company containing rules pertaining to crane operation, descriptions of safe hitching equipment and practices, and load tables for various types of slings, shackles, "S" hooks and eyebolts with instructions for their use.

Circle 20E on reply card

Forged-steel pipe fittings for high-pressure service are illustrated and described in a 28-page Bulletin (A-3-56) published by W-S Fittings Division, H. K. Porter Company, Inc. Besides simplified charts that make it easy to obtain information on screw-end and socket-welding types, it includes a section that gives helpful data on materials selection and pressure ratings and contains hydraulic and mathematical tables.

Circle 21E on reply card

Facts about Hagan Corporation's new Model 3-15 Ratio Relay for the pneumatic control field are contained in Specification Sheet SP-4315 obtainable upon request. The device produces a true linear change in a pneumatic output signal when using "suppressed" ranges such as 3-15 psi and enables an operator to adjust the ratio between input and output signals in control systems such as fuel to air in combustion



JUST ONE Rockwell-Nordstrom Multiport Valve Does the Work of 2, 3 or 4 Ordinary Valves

For multiple flow control, you can switch from one line to another *instantly* by operating only *one* Multiport valve instead of 2, 3 or even 4 ordinary valves. Just three of the many possible switching combinations are diagrammed below.



In addition to original installation savings, Multiport valves continue to save because they're built to *stay* efficient. *Pressurized lubricant* forms a positive seal between the plug and body and also protects against corrosive-erosive elements. The seat is *never* exposed to the line fluid and the plug rides on a cushion of lubricant for *instant, quarter-turn* operation.

Rockwell-Nordstrom Multiport valves (and the complete line of *Straightway* patterns) are available in semi-steel, stainless steel, bronze and other corrosion resisting metals. Write for complete details: Rockwell Manufacturing Company, Pittsburgh 8, Pa. *Canadian Valve Licensee*: Peacock Brothers Limited.



Rockwell-Nordstrom Valves

LUBRICANT SEALED FOR POSITIVE SHUT-OFF

40th YEAR of lubricated plug valve leadership

Circle 23A on reply card

*Use One Hose for
Many Jobs!*

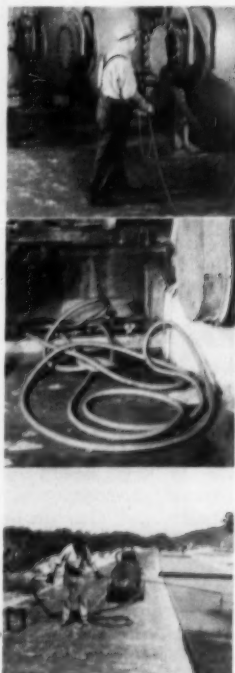


GOODALL "ALLSERV" General Purpose HOSE

"ALLSERV" will not only give long, reliable service on air and pneumatic tools, but will prove equally efficient in the handling of water, oil, gasoline, paint and insecticide spraying, grease guns, etc. The adaptability of this one hose to such a wide variety of applications provides a sure way to keep hose inventory low.

"ALLSERV" is a very flexible all-"Synplastic" (R) molded-and-braided hose, in one, two or three braid construction, with a tough wear-resistant red cover. Made in sizes $\frac{1}{4}$ " to $1\frac{1}{2}$ ", for working pressures from 200 lbs. to 300 lbs. Available in maximum lengths of 500 feet.

Contact Our Nearest Branch
for Further Details and Prices



"If it's GOODALL, it MUST be Good!"

Standard of Quality—Since 1870

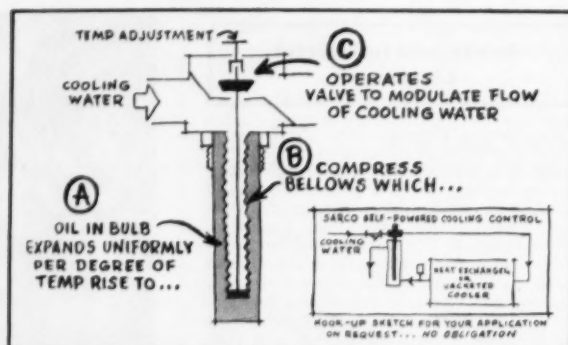


HOSE • BELTING • FOOTWEAR • CLOTHING
AND OTHER INDUSTRIAL RUBBER PRODUCTS

GOODALL Rubber Company

GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.
Branches and Distributors Throughout the United States and in Canada

Circle 24A on reply card



You can stop

OVERCOOLING WASTE

Manual control of cooling water is so uncertain it's sure to result in OVERCOOLING (waste of water), UNDERCOOLING (damage to product or equipment).

It pays to assure optimum safe temperature by using Sarco Cooling Controls:—

1. Save water and replace guesswork with certainty.
2. Trouble-free design as simple as A-B-C!
3. Self-powered...no electricity or compressed air needed.

4. Self-contained...no exposed mechanism.

5. Packless...no stuffing gland to wear or jam the valve stem.

6. Thousands provide dependable service for firms such as Ingersoll-Rand, Butler Mfg. Co., Swift & Co.

$\frac{3}{4}$ " size—only about \$39!

Write for bulletin 710 to
Sarco Company, Inc., Empire
State Bldg., New York 1, N. Y.

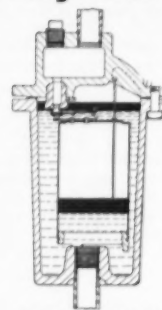
SARCO

2104-P

Circle 25A on reply card

THIS AIR TRAP is not stopped by oil

NOW you can get dependable, automatic drainage of water from compressed air intercoolers, aftercoolers, receivers and separators even though the compressor is pumping heavy oil. Any oil reaching Armstrong Inverted Bucket Air Traps collects at the top and is discharged ahead of the water.



Inverted Bucket Air Traps.

Armstrong Air Traps have a simple, proven design; there's nothing to stick, bind or clog. Stainless steel mechanism resists corrosion. For pressures to 600 lbs. *Guaranteed to Satisfy.*

Side-inlet side-outlet
styles available.



ARMSTRONG MACHINE WORKS
885 Maple Street • Three Rivers, Michigan

SEND FOR FREE BULLETIN No. 2022
GIVING DETAILS



Manufacturers of the well known ARMSTRONG STEAM TRAP

Circle 26A on reply card

processes, gases in gas mixing, and proportional feeding of chemicals. Maximum input and output signals may be at any value up to and including 20 psig.

Circle 22E on reply card

The chemical composition, physical, mechanical and high-temperature properties and other facts about Hastelloy Alloy R-235 are contained in a booklet issued by Haynes Stellite Company. It is a wrought, nickel-base, and aluminum- and titanium-bearing alloy produced by vacuum melting.

Circle 23E on reply card

Durolite sheaves, a basic part of Durolite wire-rope blocks made by Sauerman Bros., Inc., are now available as a separate item for other blocks. They range in size from 6 to 24 inches, and detailed information about them is contained in a folder being distributed by the company.

Circle 24E on reply card

The Gustav Wiedeke Company has announced a 32-page catalogue dealing with its Ideal tube cutters, expanders and operating accessories. It contains some 300 illustrations, many of product applications, tables of sizes and a list of distributors, all indexed for ready reference.

Circle 25E on reply card

Windstorm Damage Prevention is the title of a 40-page illustrated book that may be obtained without charge from the National Board of Fire Underwriters, 85 John Street, New York 38, N. Y. It is intended for the use of architects, engineers and others concerned with building standards.

Link-Belt Company has expanded its line of mill bearings with self-aligning roller bearings and steel housings to include sizes for shafts up to 11 inches in diameter. They are designed for heavy-duty service in steel mills, mines, foundries, etc., and are described in Book 2665 available upon request.

Circle 26E on reply card

Allegheny Ludlum Steel Corporation is distributing a new catalogue that provides complete data on its smooth hammered forgings, composite die sections and cast-to-shape tool steels. The 30-page illustrated book also contains a steel finder that gives information on the different grades of forging and casting steel made by the company.

Circle 27E on reply card

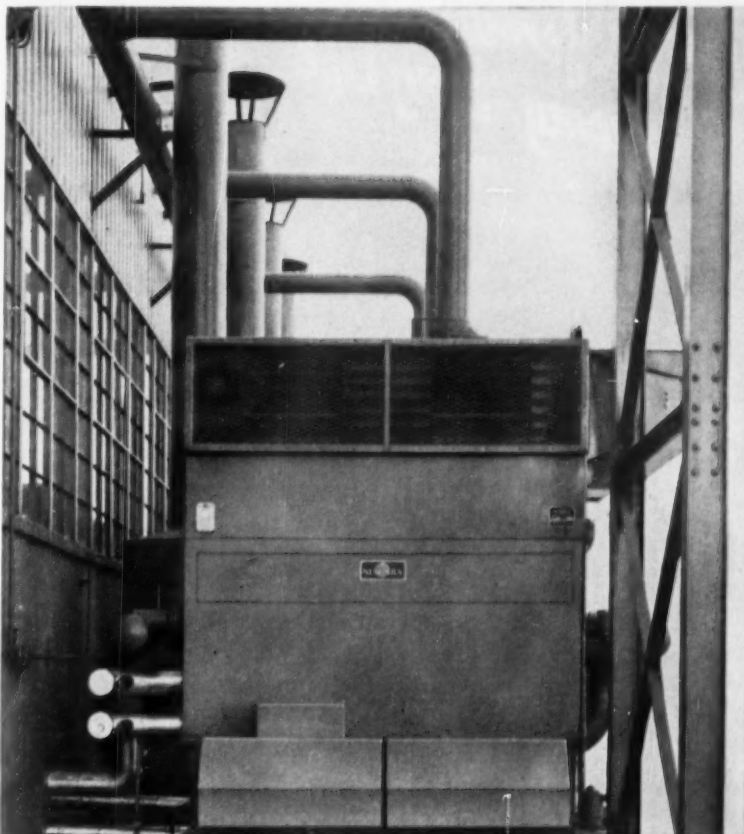
To familiarize engineers, executives and other officials in industry and government with its services and facilities for testing, applied research and engineering analyses in its expanding field of operations, Electrical Testing Laboratories, Inc., 2 East



"Hello—Maintenance?"

HOW YOU SAVE . . .

Getting Drier Compressed Air



Save the cost of Cooling Water and you save the price of the
NIAGARA AERO AFTER COOLER
(for compressed air or gas) in less than two years.

● Extra, for no cost, you get drier compressed gas or air for your process. You get better operation and lower costs in the use of all air-operated instruments, machines, or paint sprays. You save expense for piping, pumping, water treatment and disposal. You get the use of badly needed water elsewhere in your plant.

Niagara Aero After Cooler cools compressed air or gas (evaporatively) below the temperature of surrounding atmosphere, with no further condensation in your air lines.

Write for complete information; ask for Bulletin 130, or contact nearest Niagara Engineer if you have any problem involving the industrial use of air.

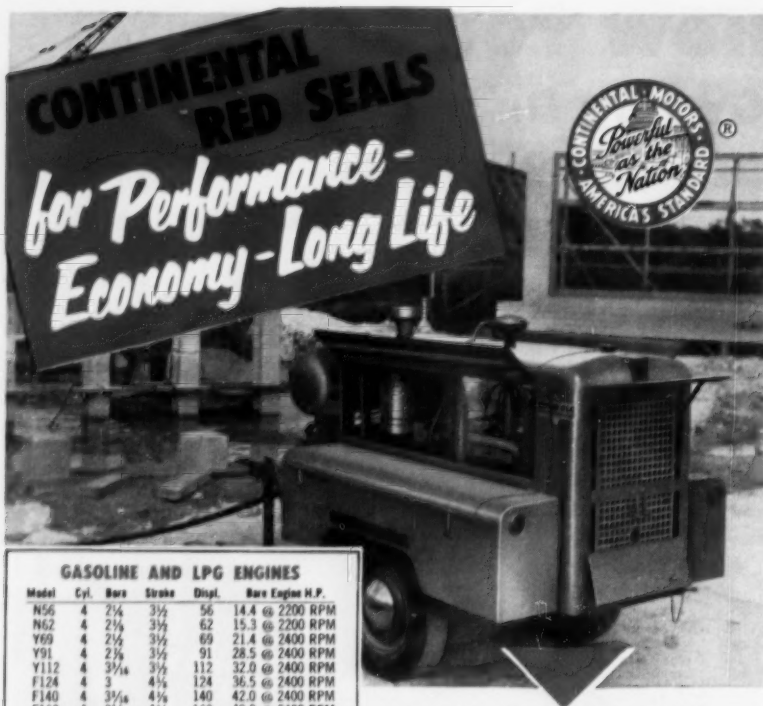
NIAGARA BLOWER COMPANY

Dept.C.A. 405 Lexington Ave.

New York 17, N. Y.

Niagara District Engineers in Principal Cities of U. S. and Canada

Circle 27A on reply card



GASOLINE AND LPG ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Base Engine H.P.
N56	4	2 1/4	3 1/2	56	14.4 @ 2200 RPM
N62	4	2 1/4	3 3/4	62	15.3 @ 2200 RPM
Y69	4	2 1/2	3 3/4	69	21.4 @ 2400 RPM
Y91	4	2 1/2	3 3/4	91	28.5 @ 2400 RPM
Y112	4	3 1/4	3 3/4	112	32.0 @ 2400 RPM
F124	4	3	4 1/4	124	36.5 @ 2400 RPM
F140	4	3 1/4	4 1/4	140	42.0 @ 2400 RPM
F162	4	3 1/4	4 1/4	162	49.0 @ 2400 RPM
F186	6	3	4 1/4	186	60.5 @ 2400 RPM
F209	6	3 1/4	4 1/4	209	68.0 @ 2400 RPM
F226	6	3 1/4	4 1/4	226	73.0 @ 2400 RPM
F244	6	3 1/4	4 1/4	244	79.0 @ 2400 RPM
M271	6	3 3/4	4 1/4	271	86.2 @ 2400 RPM
M290	6	3 3/4	4 1/4	290	92.2 @ 2400 RPM
M330	6	4	4 1/4	330	104.4 @ 2400 RPM
M363	6	4	4 1/4	363	128.9 @ 2800 RPM
B371	6	4 1/4	4 1/4	371	110.0 @ 2400 RPM
B427	6	4 1/4	4 1/4	427	127.9 @ 2400 RPM
G134	4	3 1/4	4 1/4	134	34.2 @ 2000 RPM
G157	4	3 1/4	4 1/4	157	40.0 @ 2000 RPM
E201	4	3 1/4	4 1/4	201	65.4 @ 2400 RPM
H227	4	3 1/4	5 1/2	227	54.0 @ 1800 RPM
H243	4	3 1/4	5 1/2	243	57.9 @ 1800 RPM
H260	4	3 1/4	5 1/2	260	62.0 @ 1800 RPM
H277	4	4	5 1/2	277	66.4 @ 1800 RPM
K363	6	4	4 1/4	363	123.0 @ 2400 RPM
J382	4	4 1/2	6	382	74.0 @ 1400 RPM
T371	6	4 1/4	4 1/4	371	119.0 @ 2400 RPM
T427	6	4 1/4	4 1/4	427	140.0 @ 2400 RPM
U501	6	4 1/2	5 1/4	501	159.0 @ 2400 RPM
R513	6	4 1/2	5 1/4	513	164.3 @ 2400 RPM
R572	6	4 1/2	5 1/4	572	182.4 @ 2400 RPM
R602	6	4 1/2	5 1/4	602	191.7 @ 2400 RPM
V603	8	4 1/4	4 1/4	603	220.0 @ 2800 RPM
S749	6	5 1/4	5 1/4	749	217.0 @ 2200 RPM
S820	6	5 1/4	5 1/4	820	237.0 @ 2200 RPM

CUSHIONED POWER DIESEL ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Base Engine H.P.
Z0129	4	3 1/4	3 1/4	129	34.0 @ 2000 RPM
G0157	4	3 1/4	4 1/4	157	39.0 @ 2000 RPM
*E0201	4	3 1/4	4 1/4	201	45.8 @ 2000 RPM
H0243	4	3 1/4	5 1/4	243	55.0 @ 2000 RPM
*H0260	4	3 1/4	5 1/4	260	59.0 @ 2000 RPM
*H0277	4	4	5 1/4	277	63.2 @ 2200 RPM
*H0382	4	4 1/4	6	382	72.5 @ 1600 RPM
T0427	6	4 1/4	4 1/4	427	106.0 @ 2000 RPM
R0572	6	4 1/4	5 1/4	572	154.0 @ 2000 RPM
V0603	8	4 1/4	4 1/4	603	175.0 @ 2600 RPM
S0802	6	5 1/4	5 1/4	802	202.0 @ 1800 RPM

*Available for industrial applications only.



SERVICE AND GENUINE RED SEAL PARTS
SOLD EVERYWHERE

Continental Motors Corporation

MUSKEGON • MICHIGAN

8 EAST 45TH ST., NEW YORK 17, NEW YORK • 3017 S. SANTA FE AVE., LOS ANGELES 38, CALIF.
8219 CEDAR SPRINGS ROAD, DALLAS 8, TEXAS • 1252 DANLEIGH DRIVE, EAST POINT (ATLANTA) GA.

INGERSOLL-RAND

GYRO-FLO 105 COMPRESSOR

POWERED BY CONTINENTAL RED SEAL,
SUPPLYING AIR FOR PAVING BREAKER
CUTTING OFF CONCRETE PILING

Year after year, ever since 1902, Continental engines have been proving their dependability in a steadily-lengthening list of special-purpose machines. Today, no matter what the exact requirement of the job, there's a Red Seal model—gasoline, Diesel, or LPG—engineered and built to meet it down to the last detail—a model with the proper performance characteristics, profile, shape and weight. In the industrial line there are models at closely-spaced levels—from 14 to 240 horsepower. You find Red Seals in many types of construction and industrial equipment, in farm machines of all descriptions, and in transportation, speeding the job and proving their inbuilt qualities of performance, economy and long life.

End Avenue, New York 21, N. Y., has prepared a comprehensive illustrated bulletin of 72 pages. The firm was established 60 years ago and employs some 135 people including 24 engineers, chemists and physicists assisted by 45 technicians.

Tolerances, mechanical properties and applications of hollow aluminum bar stock (round and hexagonal) are discussed in an illustrated technical brochure printed by Harvey Aluminum. Information includes case studies and charts showing the machining characteristics of the new material as compared with conventional solid bars.

Circle 28E on reply card

Circular No. 602-2 offered by Lunkenheimer Company illustrates and describes two classes of pressure globe valves of bronze for services ranging from normal to severe. Both are available in eight sizes and provided with patented Brinallloy seats and disks that have required no repair or maintenance, it is claimed, after five years of actual application.

Circle 29E on reply card

Step-by-step instructions on how to calibrate surface plates are given in an article written by J.C. Moody and obtainable upon request from Collins Microflat Company, manufacturer of Black Granite surface plates. Using instruments available in any industrial laboratory and an auto-collimator, semiskilled workers can do the work with accuracy.

Circle 30E on reply card

Engineers planning to design or to modernize equipment incorporating Fawick Airflex clutches, brakes, couplings, power take-offs, etc., should find Bulletin 500-A announced by Fawick Airflex Division, Fawick Corporation, helpful. Among other information about its products, the 36-page book contains tables of dimensions, torque ratings and data pertinent to their selection and installation, as well as application views.

Circle 31E on reply card

Design, construction features, operation and typical applications of American Blower Corporation's Type VS Class 2 adjustable-speed Gyrol fluid drives ranging from 1 through 25 hp are described and illustrated in Bulletin 9819 now available. Data on optional speed-control mechanisms also are included, as well as selection tables for both direct-connected and belt-driven arrangements.

Circle 32E on reply card

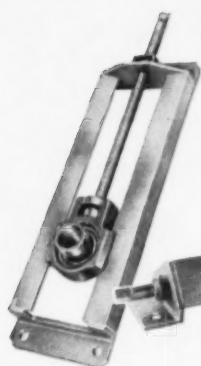


"It's a floor-pacer."

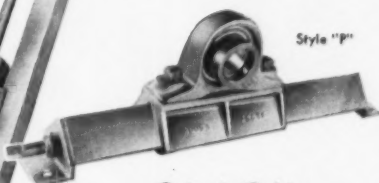
COMPRESSED AIR MAGAZINE

new...

**pre-lubricated
take-up bearings**



Style "T"



Style "P"

SLASH

maintenance costs

Pre-Lubricated At Our Factory For Life • Seals Lubri-
cant In—Dirt Out • Standard Series Ball Bearings
• Self-Aligning • Frames of Welded Structural
Steel • Can be Operated in Tension or Compression



T. B. WOOD'S SONS COMPANY

CHAMBERSBURG, PA.

Cambridge, Mass.

Newark, N. J.

Dallas, Texas

Cleveland, O.

Circle 29A on reply card



**BUY
BOTH
BOOKS
FOR
\$5.00**

Price Individual Books Per Copy

Compressed Air Data (Fifth Edition) \$3.00

Cameron Hydraulic Data (Twelfth Edition) 3.00

COMPRESSED AIR MAGAZINE, 942 Morris Street, Phillipsburg, New Jersey.
Please send me:

- ☐ Compressed Air Data and Cameron Hydraulic Data..Both books for \$5.00
☐ Compressed Air Data\$3.00
☐ Cameron Hydraulic Data\$3.00

☐ Enclosed is (money order) (check) for \$..... ☐ Send books C.O.D.
I understand that the books will be sent me postpaid, and that they may be
returned within 10 days if not satisfactory.

Name
Company
Street No.
CityStateCountry

NOW..

**GREATER THAN EVER
PROTECTION
TO YOUR AIR LINE**
with the outstanding

M·B

**WHIRL-A-WAY FILTER, REGULATOR
AND LUBRICATOR ASSEMBLY**

and AUTOMATIC

AIR TRAP

MODEL W-4



**AIR TRAP
EJECTS WATER
AUTOMATICALLY
AND RAPIDLY**

The FILTER removes solids .00039 and larger. Trans-
parent bowl provides visibility. The REGULATOR can
pass large volume with an unrestricted flow and mini-
mum pressure drop. Self-bleeding, compact. Machined
from bar aluminum.

The LUBRICATOR delivers desired volume of oil. Bowl
can be refilled without shutting off air supply.

The AIR TRAP is an Automatic Water Ejector for all air
line applications. Assures dry air in pneumatic systems
at all times. Eliminates costly downtime and assures pre-
ventive maintenance. WRITE FOR LITERATURE.

M·B PRODUCTS
46 VICTOR AVE., Div. 14
DETROIT 3, MICHIGAN

Circle 30A on reply card



Using Bethlehem Hollow at Moretti-Harrah Marble Co. quarry, Sylacauga, Ala. Drill steel supplier: Cowin Equipment Co., Inc., Birmingham, Ala.

Drilling deeper and deeper into Alabama marble

Most any day you can see plenty of broaching and drilling activity at the quarries of Moretti-Harrah Marble Company, Sylacauga, Ala., where they are quarrying large quantities of white marble, using Bethlehem Hollow Drill Steel.

Bethlehem Hollow Drill Steel, used exclusively by Moretti-Harrah, performs in drifters and jackhammers in 1 1/4-in. round and 1-in. hexagon, fitted with detachable bits. Where blasting is required, holes are drilled 14 ft deep. Reconditioning is done in their own shop, at the quarry site.

You can depend on good service from Bethlehem Hollow, no matter what the type of rock. Bethlehem Hollow is rolled from a special grade of fatigue-resistant steel, and has a uniform hole, centrally

located in the bar. It has a wide quenching range, and is easy to heat-treat for the proper balance of toughness and wear-resistance, resulting in long-wearing threads and strong shanks.

MADE IN TWO TYPES

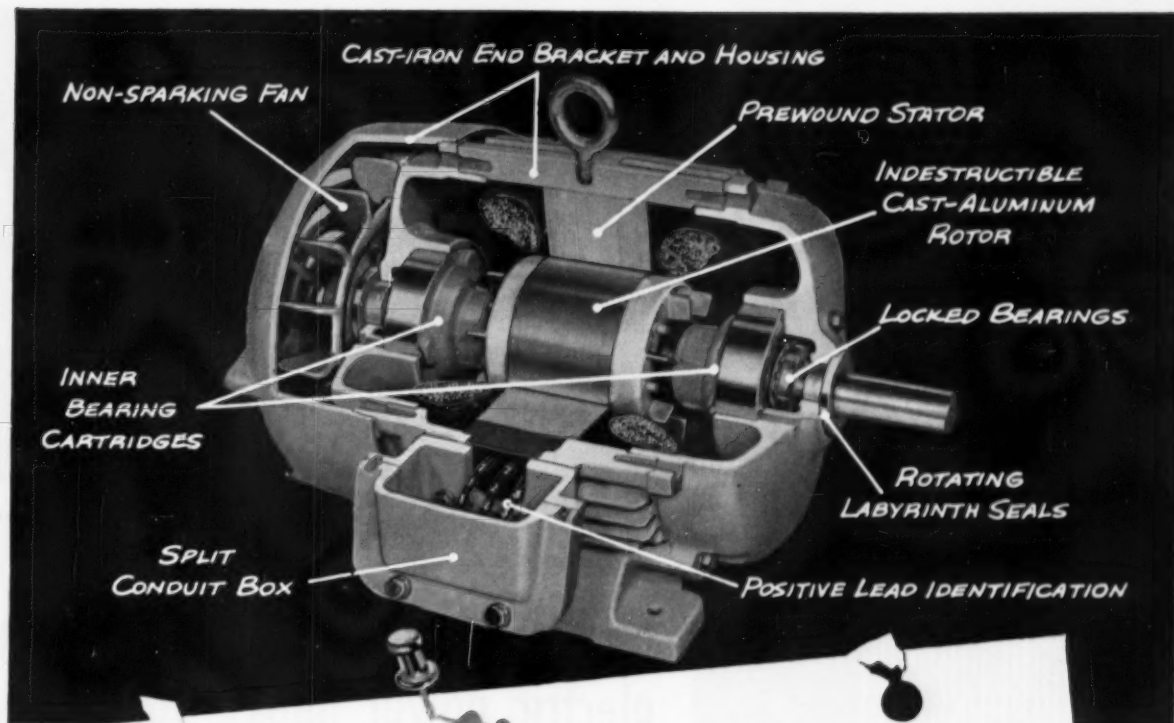
Bethlehem Hollow comes in carbon and ultra-alloy, in rounds, hexagons and quarter-octagons, in lengths up to 25 ft. Longer lengths can be supplied to meet special conditions. Give Bethlehem Hollow a try. Order it from your local converter.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation



BETHLEHEM HOLLOW DRILL STEEL CARBON AND ULTRA-ALLOY



Are you getting all these extras in the motors you buy?

Louis Allis gives them to you in the new L. A. enclosed and explosion-proof motors

For years, Louis Allis has specialized in special motors for many of industry's toughest drive problems. Such installations call for extreme care in both motor design and manufacture—care that has become a habit with us. We build our enclosed and explosion-proof motors with the same special care.

What does this mean to you? It means that you get a motor with extra features—a motor that runs better, lasts longer. Here are a few of the extra reasons why:

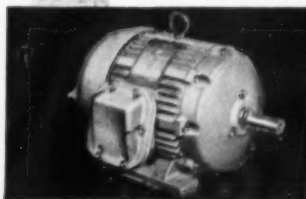
- These new motors carry Underwriters' label for use in four groups of hazardous locations—Class I, Group D, and Class II, Groups E, F, and G. This four-group approval for a single motor simplifies your stocking problem.

- New, exclusive phenolic impregnating varnish provides high thermal and chemical resistance. It remains resilient and resists aging, prolonging the life of the motor.

- Inner bearing cartridges lock bearings to end bracket and form explosion-quenching seal along the shaft. Inner race of bearing locked to shaft, reducing end play—an extra quality feature.

- Rotating labyrinth seals keep dirt and moisture out of the bearings—keep grease in.

There are many other features such as a new diagonally split conduit box, sturdy cast-iron construction, positive lead identification, non-sparking fan. Our new bulletin No. 1700 shows why you get extra value for your dollar in a Louis Allis explosion-proof motor. Write for your copy.



New LA line explosion-proof motors are available in rated frame sizes 182 through 326U, and in ratings of 1 to 30 hp, 3 phase, and 1 to 5 hp, single phase. Also available with Underwriters' approval for Class I, Group C hazardous locations.

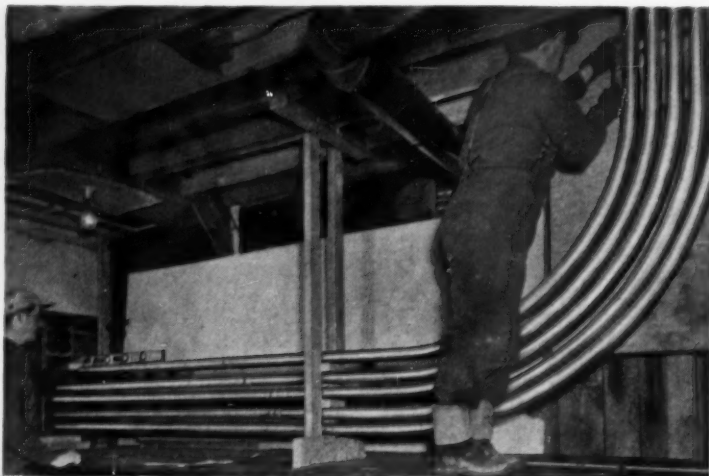


THE LOUIS ALLIS CO.
MILWAUKEE 7, WISCONSIN

EP-102

DOWN a humid 180 feet
below water level at
Downsville Dam

UP in the corrosive air
at a water cooling tower



Some 3600 feet of 2" Everdur Conduit (E.M.T.) protect electric lines in a service shaft plunging down to the release water chamber 180 feet below water level at Downsville Dam of the New York Metropolitan Water Supply System. Electric lines operate vital valves, indicating and communication equipment.

EVERDUR Conduit will guard the electric power lines—for years

Everdur® Never Rusts. It offers high resistance to other types of corrosion. That's why Everdur Conduit—made from one of Anaconda's exclusive copper-silicon alloys—is specified for dependable year-after-year protection of electric power lines in industry, on bridges, at power and water supply projects—wherever water and corrosive atmospheres are a problem—or where conduit must be buried or embedded in concrete.

Everdur is Tough. In addition to corrosion resistance, Everdur has high physical strength, resists wear and abrasion. It stands up under movement and vibration, as on a bridge, in a subway, in a factory.

Everdur is Nonmagnetic. Everdur Conduit creates no magnetic field to produce temperature rise in electric power cables.

Everdur Electrical Conduit is available in two wall thicknesses—R.C. in nominal sizes from 1/4" to 4", inclusive, and E.M.T. in nominal sizes 3/8" to 2", inclusive. For more detailed information write: The American Brass Company, Buffalo Division, Buffalo 5, N. Y. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

55120A

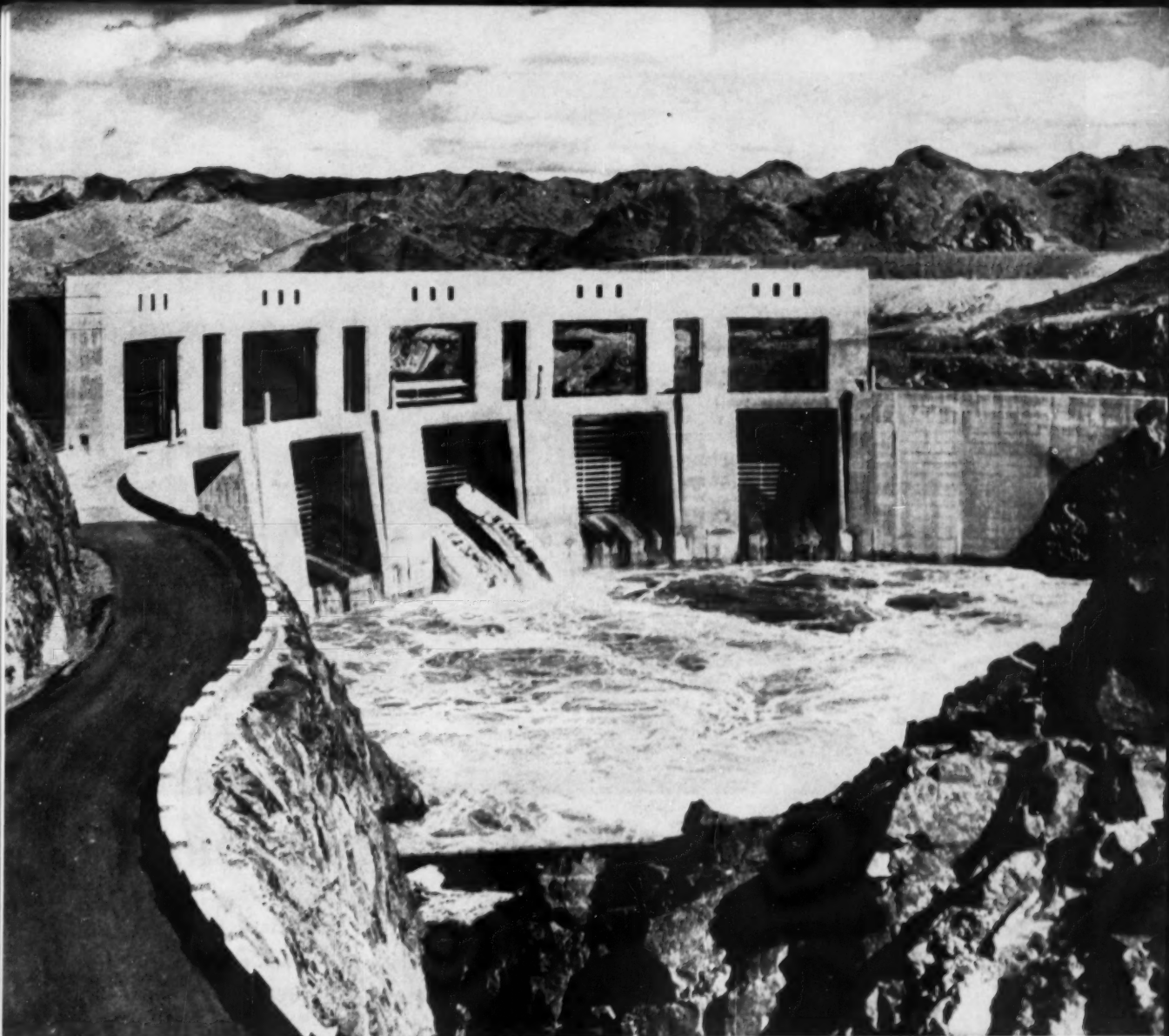
*Reg. U. S. Pat. Off.

EVERDUR ELECTRICAL CONDUIT

ANACONDA®
COPPER SILICON ALLOYS

During the War, General Petroleum Corp. saw galvanized conduit fail within a year at one of its plants—replaced it with Everdur Conduit. At its new Ferndale Mobilgas Refinery in Washington, some 12,000 pounds of Everdur Conduit in various sizes guard electric power lines for motors and lighting in this water cooling tower.

CORROSION RESISTANT • STRONG • NONMAGNETIC • WORKABLE • WELDABLE



IMPOSSIBLE WITHOUT EXPLOSIVES

PARKER DAM on the 242-mile-long Colorado River —Los Angeles Aqueduct is another example of the many large construction jobs that Hercules® explosives and blasting supplies have helped to build.

Parker Dam and other such mammoth projects would be *impossible without explosives*.

Whether your blasting requirements are routine or unusual . . . whether they involve construction, mining, quarrying, or other industrial applications . . . you can depend on Hercules' knowledge and experience in the manufacture of blasting materials, and their uses, to make your job easier.

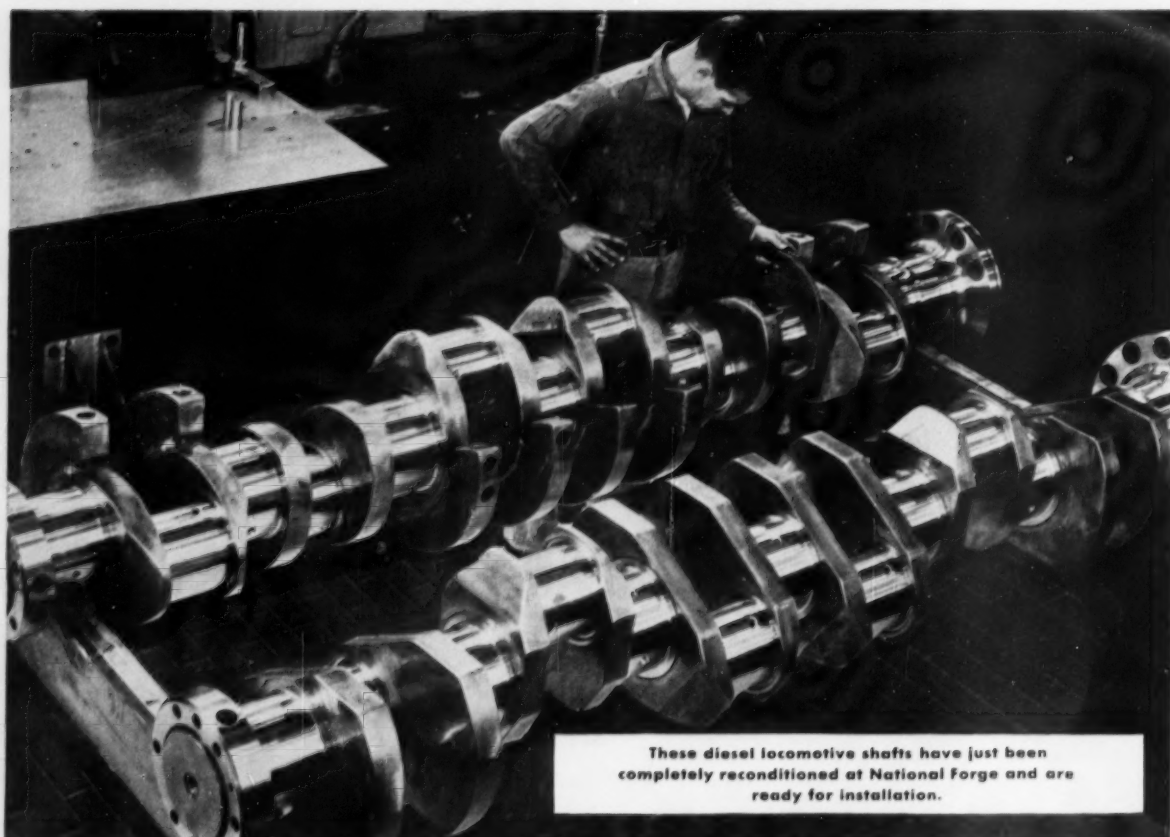
HERCULES

HERCULES POWDER COMPANY

Explosives Department, 932 King St., Wilmington, Del.

Birmingham, Ala.; Chicago, Ill.; Duluth, Minn.; Hazleton, Pa.; Joplin, Mo.; Los Angeles, Cal.; New York, N. Y.; Pittsburgh, Pa.; Salt Lake City, Utah; San Francisco, Cal.





These diesel locomotive shafts have just been completely reconditioned at National Forge and are ready for installation.

RECONDITIONING DIESEL LOCOMOTIVE SHAFTS

● National Forge has been well recognized as a supplier of quality crankshafts for original equipment for over forty years. Through these years we have kept abreast of the steadily increasing demands for greater quality and workmanship.

Now this experience and "know how" have been applied to the problem of reconditioning worn crankshafts. National Forge has established

a complete and separate department for this rebuilding which includes a newly developed chromium plating process and facilities for straightening, grinding and polishing.

National Forge offers you this complete rebuilding service for your worn crankshafts. We will be pleased to have your inquiries and will be glad to have our field representatives discuss this service with you.



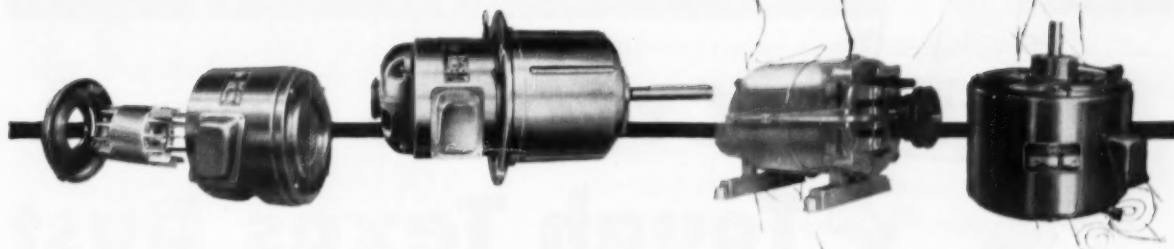
NATIONAL FORGE AND ORDNANCE COMPANY

PRODUCES BETTER STEEL FORGINGS AND MACHINE WORK

IRVINE, WARREN COUNTY,
PENNSYLVANIA



Time for more torque



When you plan to purchase new motors, you'll want the best—at the most reasonable cost. You will demand built-for-the-job efficiency, and no compromises with quality. You will expect co-operation at each stage of design and development—and on through to manufacture and delivery on the date specified. And after installation, you'll want long-life and the minimum of down-time for servicing. At all times, you will appreciate being a special customer of the motor manufacturer—whether you buy one, or one hundred motors.

All this you can expect from Diehl. The best built-for-the-job motor at the most reasonable cost. You will get the benefit of 69 years of Diehl know-how applied to your particular requirements. For Diehl design, sales and installation engineers comprise one of the finest teams of electric motor experts in America today.

The emphasis at Diehl is on close liaison with all customers at every stage of production. Give your power problems to a Diehl motor specialist. Get the right answers and the best motors—fast. You invest in performance when you design with Diehl.



DIEHL MANUFACTURING COMPANY

Electrical Division of THE SINGER MANUFACTURING COMPANY
Finders Plant, Somerville, N. J.

Please send me Bulletin No. 3526

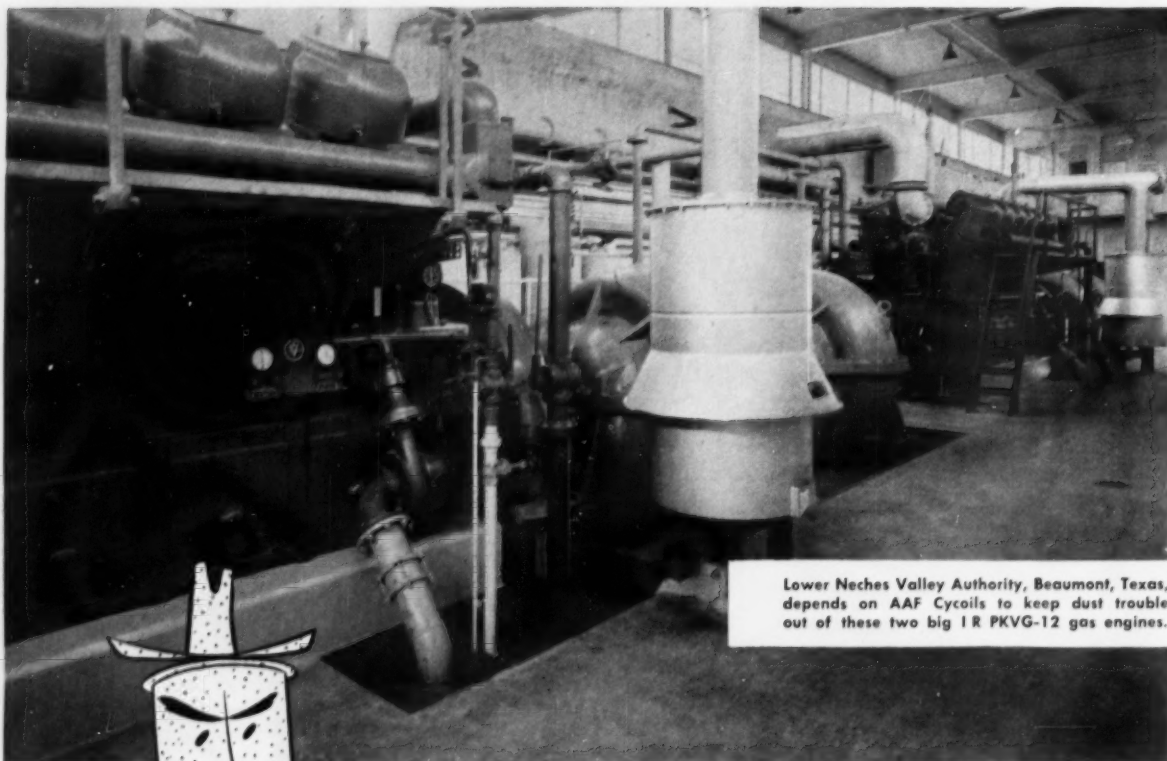
Name

Company

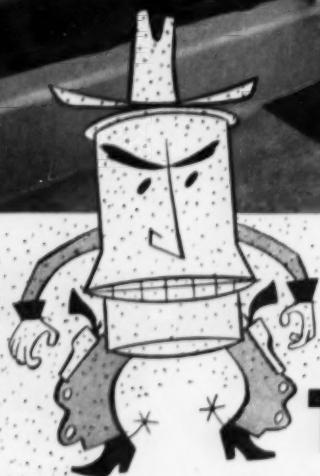
Street

City State

INTEGRAL AND FRACTIONAL HORSEPOWER MOTORS ARE
AVAILABLE IN A WIDE RANGE OF TYPES AND SIZES



Lower Neches Valley Authority, Beaumont, Texas, depends on AAF Cycoils to keep dust trouble out of these two big 1R PKVG-12 gas engines.



CYCOILS Corral Tough Texas Dust

THESE two gas engines each drive two pumps in tandem, with capacity of 110,000 gpm per unit, for the Lower Neches Valley Authority, Beaumont, Texas. It's a big job. There's no time for down-time.

That's why you see those AAF Cycoil heavy-duty oil bath air cleaners on the job. They provide 4-way cleaning—impingement, scrubbing, cyclonic action and filtering. Over 90% of the fine dust content in

the air is trapped in oil and removed by centrifugal action before most of it even reaches the filter pads! Additional action of filtering pads, what's more, plus positive oil circulation for self-cleaning action, provides air that's virtually 100% dust-free.

Only Cycoil gives engines and compressors this kind of protection. Write for Bulletin No. 130 . . . the nuts-and-bolts, facts-and-figures story on Cycoil Oil Bath Air Filter!



American Air Filter
COMPANY, INC.

402 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

Type CMS
Multi-Duty Filters



Type G Pipeline
Air Filters



— BETTER AIR IS OUR BUSINESS —

Type OCH
Intake Air Filters



Cycoil Oil Bath
Air Filters



Here's why Celanese fire-resistant CELLULUBES give you top lubricating features

Celanese Cellulubes are phosphate ester fluids designed to minimize the hazard of flash fires and explosions inherent in many industrial operations.

CONTAIN NO ADDITIVES

Because they contain no additives, Cellulubes give you excellent lubricating qualities, in addition to built-in fire-resistance. Just check these basic advantages offered by Cellulubes:

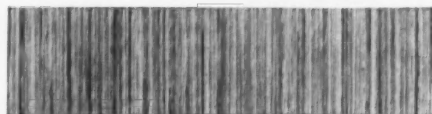
- **FIRE RESISTANCE**—extremely high auto ignition point (over 1100° F.)
- **LUBRICITY**—excellent; low wear factor
- **GRADED VISCOSITY**—range of 6 controlled viscosities—90, 150, 220, 300, 500, and 1000 (S. U. S. @ 100° F.)
- **STABILITY**—unaffected by heat, wear or oxidants
- **NON-CORROSIVE**—in ferrous or non-ferrous systems
- **NON-FOAMING**—contain no additives; resist hydrolysis
- **LONG-LIFE**—chemically and physically stable
- **MINIMUM MAINTENANCE**—no viscosity adjustment required

As air cylinder lubricants in compressed air systems, Cellulubes prevent the formation of excessive carbon deposits—the major cause of compressor fires. As hydraulic fluids, they reduce the danger of fires due to line breaks or other failures.

If you would like to evaluate Cellulubes in your own operation, use coupon below to order working samples and complete use data.

¹ From a report in *Lubrication Engineering*, July-Aug., 1956, entitled "A Study of Combustion Resistant Hydraulic Fluids as Ball Bearing Lubricants," by H. V. Cordiano, E. P. Cochran, Jr., and R. J. Wolfe.

Reprints of this article are available from Celanese Chemical Division on request.
EXPORT SALES: Amcel Company, Inc. and Pan Amcel Company, Inc., 180 Madison Avenue, New York 16, N. Y.



UNUSED PATH



PHOSPHATE ESTER



PETROLEUM OIL



PHOSPHATE ESTER BASE



WATER-GLYCOL BASE

Photomicrographs of the surface of ball path of bearing operated in four hydraulic fluids: petroleum oil, phosphate ester, phosphate ester base, and water-glycol base. Fluids were evaluated on a transfer test machine where angular contact bearings were operated to point of failure. Of the combustion resistant fluids tested, the straight phosphate ester gave the longest bearing modal life and the related ball path showed the least number of microscopic pits.¹

Celanese Corporation of America, Chemical Division, Dept. 396-J
 180 Madison Avenue, New York 16, N. Y.

Please send me working sample and technical bulletin on Cellulube for air compressor service ☐ for hydraulic systems ☐ Send technical representative ☐

NAME _____ TITLE _____

COMPANY _____

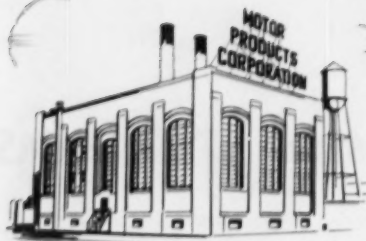
ADDRESS _____

CITY _____ ZONE _____ STATE _____



Cellulube® Celanese®

Ingersoll-Rand steam-driven compressor pays for itself in three years



When Motor Products Corporation modernized their main Detroit plant, they installed an Ingersoll-Rand XPV steam-driven compressor at the advice of their consulting engineers, Boddy, Benjamin and Woodhouse, Inc. This modern compressor improved plant steam balance by utilizing available steam.

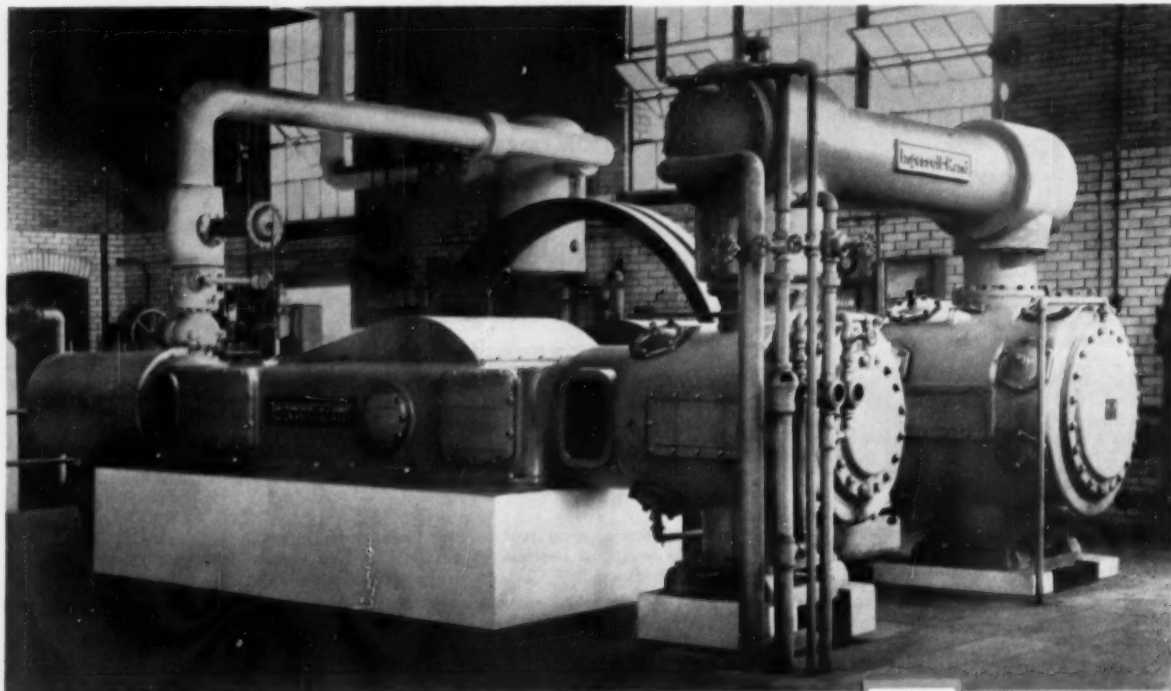
The exhaust steam from the compressors is used for building heating and feedwater heating. At full load, this compressor saves \$26,000 a year in power costs over the old electric-driven unit it replaced.

This saving will repay the original cost of the compressor in only three years.

Not every compressor can save this much in a single installation, but by careful selection, application and control, Ingersoll-Rand compressors can be adapted to give the utmost economy under any given set of conditions. Your I-R representative will help you find the compressor and conditions that give the most air power for your investment.

Ingersoll-Rand steam-driven compressors are available in sizes from 10 to 2500 horsepower. Other types are available in sizes from 1/2 to 6000 horsepower, pressures to 35,000 psi and vacuums. All units are built to the exacting Ingersoll-Rand standards of durability and economy of operation.

This 1950 cfm XPV steam-driven compressor furnishes 100-psi air at the Motor Products Corporation plant in Detroit, Michigan.

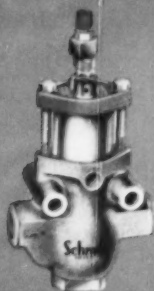


Ingersoll-Rand

1-441 11 Broadway, New York 4, N. Y.



COMPRESSORS • CONDENSERS • AIR & ELECTRIC TOOLS • PUMPS • ROCK DRILLS • GAS & DIESEL ENGINES



Schrader 3-WAY PILOT VALVES, which respond to the out-of-phase cam-operated valves, automatically actuate unscrambling actions on conveyor. Some other Schrader Air Products involved in this operation are indicated in red (Numbers 1 through 5).



How Schrader Air Products automatically *unscramble paraffin blocks—unwatched!*

Arranging bars of hardened paraffin from a disorganized pile to orderly groups of five, ready for packaging, is a cinch at one New York plant. Schrader Air Products do the job fast and accurately, unattended. Air-activated "fingers" of metal do the trick, as fast as the bars descend the incline.

Every day, new ways are discovered for performing operations automatically with Schrader Air Products. Schrader's line of industrial products includes hundreds of units which can be arranged in limitless combinations for thousands of

different jobs. And air always brings to any job its basic economy, safety and efficiency.

Do you know the Schrader story in relation to your plant's needs? Learn it now, by asking for Schrader engineering assistance in planning for most efficient use of air in your plant. Outline your problems for us and we can help you select the products best suited to your applications. Or, send for the latest informative booklets which show Schrader Air Products that will help you increase production—economically.



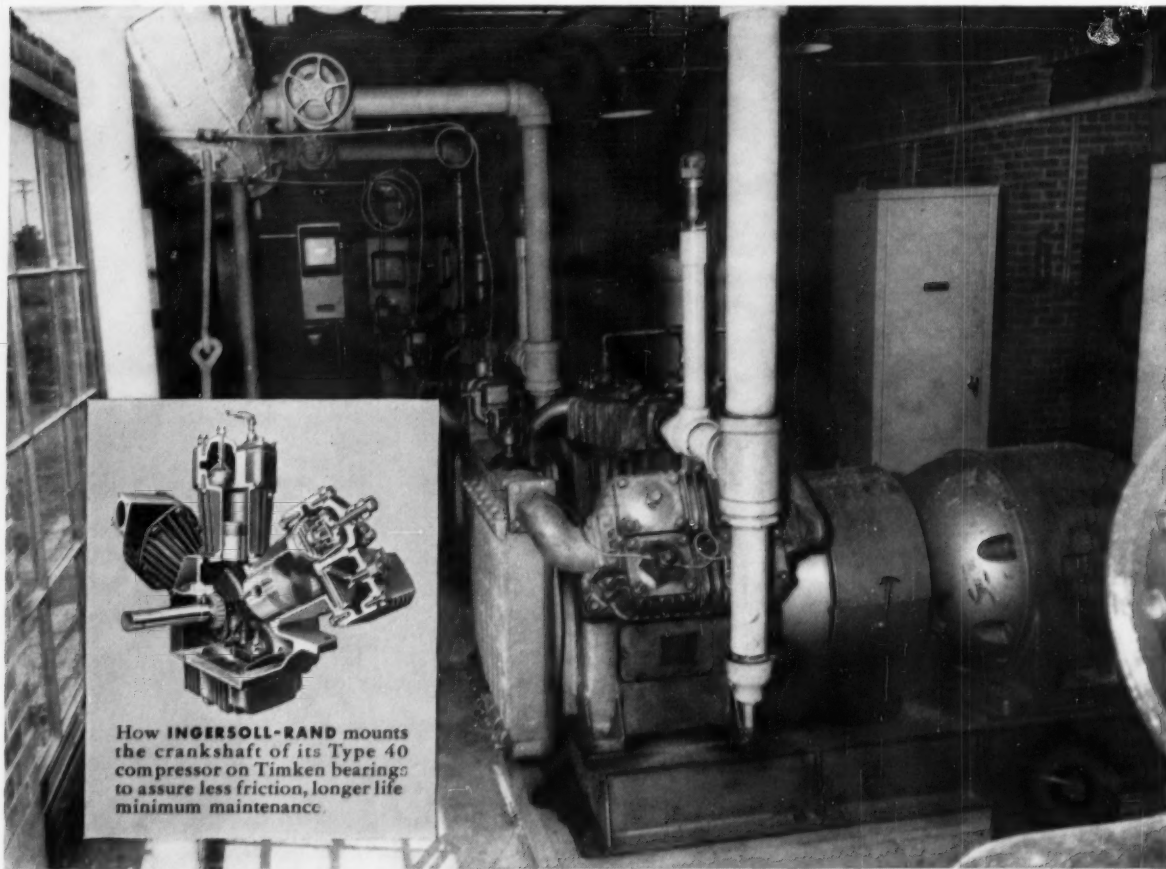
Schrader®

ESTABLISHED IN 1844

A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
478 Vanderbilt Avenue, Brooklyn 38, N. Y.

FIRST NAME IN THE USE OF AIR
FOR INDUSTRIAL PRODUCTION AND CONTROL

Circle 40A on reply card



Air keeps freight cars from bumping— **TIMKEN®** bearings keep it pumping

IN classification yards where modern freight trains are assembled, cars are rolled down a hill called a hump. Braking is done by means of a flange that moves beside the track to rub against the wheel. The flange is moved by compressed air. If the air pressure is low, the flange can't push hard enough. The freight car bangs into other cars and lading is damaged.

To make sure this compressor in the classification yard of the Chicago, Milwaukee, St. Paul and Pacific Railroad at Bensenville, Ill. gave a reliable supply of compressed air, Ingersoll-Rand used Timken® tapered roller bearings on the crankshaft. Timken bearings practically eliminate friction,

keep the crankshaft in rigid alignment, minimizing wear on adjacent parts. Crankshaft wear is eliminated. Compressors run more efficiently and dependably.

Timken bearings are geometrically designed to give true rolling motion. And they're precision manufactured to live up to their design. We even make our own steel to watchdog quality from melt shop to final bearing inspection. No other bearing manufacturer in America does.

Make sure you get all these advantages in the bearings of machines you buy or build. Specify Timken tapered roller bearings. Look for the trademark "Timken" on every bearing.

The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable: "TIMROSCO".



This symbol on a product means its bearings are the best.



TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS ROLL THE LOAD

Circle 41A on reply card